JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the act of Congress March 3, 1879.

VOL. XXXII NO. 13 SAN FRANCISCO, MARCH 28, 1914 PER COPY, 25 CENTS

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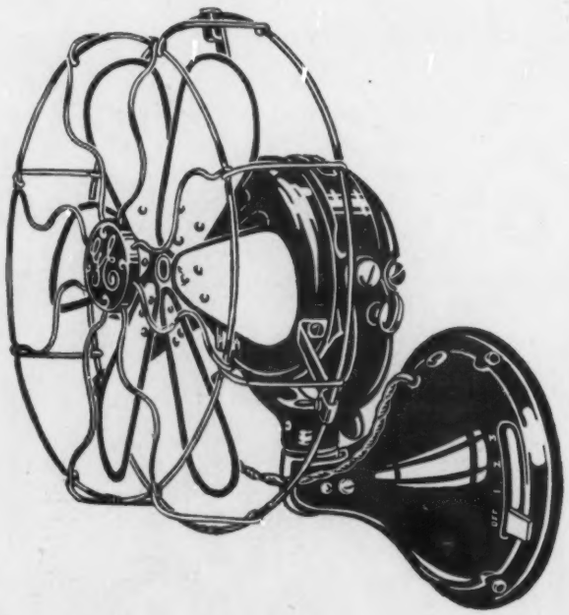

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JOURNAL OF ELECTRICITY
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VOLUME XXXII | SAN FRANCISCO, MARCH 28, 1914 | NUMBER 13

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POWER SITUATION IN OREGON

BY W. H. CRAWFORD.

(This article details the steam and water power plants of the various companies operating in Oregon and the capacities of each. Describes, in part, the possible and projected water power development and mentions the immense amount of power available for the industrial development of that state. Incidentally, the author refers to an economic condition obtaining in Oregon which favors the installation of steam power plants, notwithstanding the enormous water power possibilities. Mr. Crawford is manager of the Portland office, Chas. C. Moore & Co., Engineers, Inc.—The Editors.)

The great Northwest has always been regarded as a district with wonderful water power possibilities. However, it has lacked the necessary population and the industrial activity to warrant development of these possibilities to a condition of commercial usefulness. That is to anything like what might be expected.

If our great centers of population were only located near the water power or if the water power would manifest itself on the outskirts of our big cities we would have an ideal condition. But fate seems to decree that the people shall live and work in one place and the water sheds have their fall many miles away.

Oregon with an area of 96,700 sq, miles and a population of approximately 750,000 people, forms an interesting study at this time. About one third of the population is located at a single point on the Northern border of the state, Portland, where the Willamette River joins the Columbia. The other two-thirds is scattered principally along the Northern and Western borders of the state, and there are only five centers of population outside of Portland having over ten thousand people. These are the cities of Astoria, Salem, Baker City, Eugene and Medford.

At this writing, taking the state as a whole, there is a great surplus of electric power developed and on the market. This should confirm the supposition stated in the opening paragraph that the Northwest is a district with wonderful water power possibilities, since in spite of a relatively poor market, there has

Celilo Falls on the Columbia River

Station E—Portland Railway, Light & Power Co.

been an over development. In certain parts of the state there may be a shortage due to some local conditions, or to isolation of the district, but in general the over-development is marked. Oregon's position in the power field is ideal to the consumer of power, and the faith of those investors who have brought the product to the market, will surely be rewarded in the near future by a natural and rapid growth in industrial activity that is bound to absorb any over development.

In addition to the developments within the borders of the state high tension power lines have been carried across the state line in many places from outside locations with a wealth of power behind them. These when tied into our own plants make a system of excellent supply.

Beginning with the northern border we find the Pacific Power & Light Company, operating a system of power plants and transmission lines along the Columbia River, that are the biggest possible asset to this promising territory. Within the state they have developed about 2250 kw. near The Dalles and 250 kw. at Hood River, but the big supply comes in over lines from Washington in the neighborhood of Walla Walla. This company does not reach into the Portland territory but passes on down the Columbia to Astoria where they operate a disconnected system. The Astoria situation is of interest because of an arrangement made at that point with the Hammond Lumber Company, whereby the latter supplies current in wholesale quantities to be distributed by the power company. Before this scheme was perfected an old steam plant of 800 kw. capacity was Astoria's supply. When available water power sites were investigated it was found that a cheaper and quicker development was at hand, and this is characteristic of the Oregon field. The Hammond Lumber Mill close by was wasting great quantities of exhaust steam and burning tons of mill refuse in destroyers. It was not difficult to arrange for the installation of two 750 kw. exhaust steam turbines at the lumber mill, and have the latter sell current to the power company. This was accomplished about three years ago, when the old steam plant was placed out of commission and held in reserve. With the growth of the prominent saw mills we find them going over to electric drive. They are not promising customers for the power company since they can cheaply produce their own power, and this also makes them possible competitors.

Thus an arrangement as at Astoria is highly cooperative and profitable, enabling the mill to produce revenue from waste, and saving the power company expense of pole lines outside of the distribution district, right of way costs and maintenance, and any of the other heavy costs of a water power development.

On the southern border of the state the lines of the California-Oregon Power Company reach in from the south and connect with water power plants at Gold Ray 2000 k.v.a. and Prospect 4750 k.v.a. This company also operates an 850 k.v.a. steam and water plant at Klamath Falls.

On the eastern border the Eastern Oregon Light & Power Company have lines extending throughout a district of which Baker and La Grand form a natural center, and have a total generating capacity of about 1500 kw. distributed between Baker, La Grand, Cove, Rock Creek (Haines) and Olive Lake (Sumpter).

The Idaho-Oregon Light & Power Company, has no power development at present in operation within the state although working at Ox Bow on the Snake River at this writing. They import power however into eastern Oregon around Huntington.

The Enterprise Electric Company has about 500 kw. water power divided between Enterprise and Willowa.

Recent competition around Baker has appeared in the shape of the Eagle River Electric Company, with about 750 kw. water power and the city of Baker with 100 kw. developed locally from their water system.

Along the western border of the state we find a few small plants of an independent nature, and a few in the Willamette Valley. There is one good system or chain of plants operated by the Oregon Power Company with a 3000 kw. steam plant at Springfield as the basis. This station is located along side of the big Booth-Kelly lumber mill where an exchange of mill refuse fuel and current is made. This presents a modification of the Astoria situation. At Albany and Dallas the Oregon Lumber Company has additional generating capacity in steam and water to the extent of about 1000 kw. tied into lines from Springfield.

The same company operates a disconnected system at Marshfield on the coast securing current from the biggest lumber mill in the state. This arrangement is again a little different from either Astoria or Springfield in that the C. A. Smith Lumber & Manufacturing Company installed a complete 2500 kw. generating station for the purpose of taking care of their own needs and selling the surplus to the power company for local distribution. The power company then shut down its 500 kw. steam plant at that point, holding same in reserve.

A partial list of the small independent plants in this district may be of interest. Including both coast and Willamette Valley we find approximately:

Small Independent Plants and Capacities Tabulated.

150 kw. in steam power at Tillamook.
275 " " " " Bandon.
100 " " " " Newport.
275 " " " " Bay City.
390 " " " " Seaside.
275 " " " " Newburg (Now P. R. L. & P. Co.)
135 " " " " Cottage Grove.
100 " " " " "Forrest Grove.
225 " " " " Sheridan.
450 " " " " Winchester (Roseburg).
150 " " " " Coquille.
250 " in water power at Canby.
950 " " " " Winchester (Roseburg).
100 " in steam and water at McMinnville.
100 " " " " " Lebanon.

When we turn to the more thickly populated territory around the city of Portland where about one-third of the state's people reside, we find a most interesting situation. In the first place the Portland Railway, Light & Power Company is the old established power company with a system that would be a credit to any community. They have spent money liberally to provide for future requirements as well as present perfection. Their lines reach out into the surrounding country for something like fifty miles in three different directions, and across the Columbia River to the city of Vancouver, Washington.

This company has several good water power and steam power plants all tied in together, the best of which are as follows:

Plants of the Portland Railway, Light and Power Company.

Steam Stations—
6000 kw. located near the Inman-Poulsen Lumber Mill, Portland.
2500 kw. " " the Peninsula Lumber Co., St. Johns.
12500 kw. " " the Eastern & Western Lum. Co., Portland.
950 kw. " at Salem, Oregon.

Water Power—
14250 kw. located at Cazadero.
9900 kw. " " River Mill.
7230 kw. " " Oregon City.
10125 kw. " " Bull Run.

The total installed capacity is given as 66,580 kw. In making their developments at River Mill and at Bull Run the Portland Railway, Light & Power Company also provided for some future extensions so that when the time came to expand they would have only the turbines and generators to purchase. This enables them to enlarge River Mill to the extent of 6600, and Bull Run 3375 kw. at minimum expense and in short time when needed.

Station B, at Oregon City.

One of the biggest demands on the service of the Portland Railway, Light & Power Company is made by the electric railways running out of Portland in every direction. The longest extension so far is that of the Oregon Electric Railway Company to Eugene, 123 miles south. The Portland, Eugene & Eastern is also opening its line to Eugene, and several other links of what will some day be a great system throughout the Willamette Valley.

Regardless of the great abundance of power behind a long distance transmission line it seems from experience that in railway work the lines must not be made too long, or if of any great length, they must be backed up by steam plants at frequent intervals to insure service in cases of emergency. On account of the sawmill feature of the power situation in Oregon, it would seem that in the case of the Willamette Valley development, that one or two combinations similar to Astoria, Marshfield or Springfield would be the natural solution.

A new company has just entered the Portland field, the Northwestern Electric Company. This is another inter-state company. Current is brought from across the Columbia River where a 12,000 kw. development on the White Salmon River was made last year. It is understood that originally the White Salmon project was intended to provide power for the paper mills at Camas, Washington, but it was found to be an expensive undertaking, and not advisable unless carried out to the full extent of its possibilities. Therefore two 6000 kw. units were installed and provision made for about 5000 kw. additional capacity when needed. The power lines were carried down to Camas, and then across the river and into Portland.

To carry out a policy of absolute reliability regardless of expense the Northwestern Electric Company decided early in their campaign to establish a steam plant reserve in Portland. They purchased a block of land on the Willamette River near the geographical center of the city and prepared to build a condensing steam station, of typical design for stand-by service. However since a sub-station would have to be established in the midst of the direct current district to take care of converters and transformers as well as a possible storage battery installation to match up with the service provided by the older company, it was later decided to undertake quite an unusual project.

The condensing plant idea was given up and consideration of storage batteries eliminated by establishing a non-condensing steam plant in the midst of the business district. This plant is to run all the time delivering its exhaust steam into heating mains. The non-condensing steam turbines while running up to speed are not intended to produce current unless there is an interruption to the water power service. They are in a measure big reducing valves, but since they are to be kept warm and in operating condition, they will be just as quick as storage batteries in getting in on the line.

The turbines in reality float on the line with throttle wide open, but governor closed, when not generating, hence at those times steam must be passed into the heating mains by means of automatic valves. Just as soon the turbine begins to generate then it becomes the reducing valve and all steam passes that way.

The heating business in itself holds out great promise at Portland and this combination plant is expected to prove profitable as well as mechanically adapted to local conditions.

The same financial interests that backed the Northwestern Electric Company were at this time putting up a fine big office building in Portland known

as the Pittock block and the basement of this building was modified to receive the steam plant consisting of two 3500 kw. turbines six 500 h.p. Stirling boilers and entire equipment of generating, switching and transformer station.

A substation was located on the block originally purchased for steam plant and with the growth of business in the years to come may eventually embrace a complete condensing plant, although this is not contemplated at present. The Pittock Block is located in a very favorable position for the heating business and the elaborate underground piping system is the best that money could buy.

A new factory district to the north of Portland came into being a few years ago and has had a steady growth ever since. The Monarch Lumber Company promoters located their big mill on the edge of this district and took advantage of their strategic position to add a power business to the mill. Two 750 kw. high pressure turbines were installed to serve the district and had a practical monopoly of the power end as long as the mill operated. Some time ago the mill was forced to close down and the power business was taken over by the Portland Railway, Light & Power Company who supply the service from its transmission lines.

This combination of big saw mills are now utilizing their refuse (that formerly went to waste) by burning it under the boilers at central power stations. The electrical energy generated in excess of their own requirements being sold. Because this economical combination of power plants in conjunction with sawmills is proving so successful, many engineers are quite undecided as to the advantage of the usual water power developments when the central power plant feature can be worked out. Anything that gets away from long pole lines, right of way troubles, and expensive dam or flume construction seems to be a step in the right direction. As noted above we have four striking examples of what can be done on this plan in Oregon, at Springfield, Astoria, Marshfield and North Portland, to say nothing about the steam stations of the Portland Railway, Light & Power Company located adjacent to big sawmills.

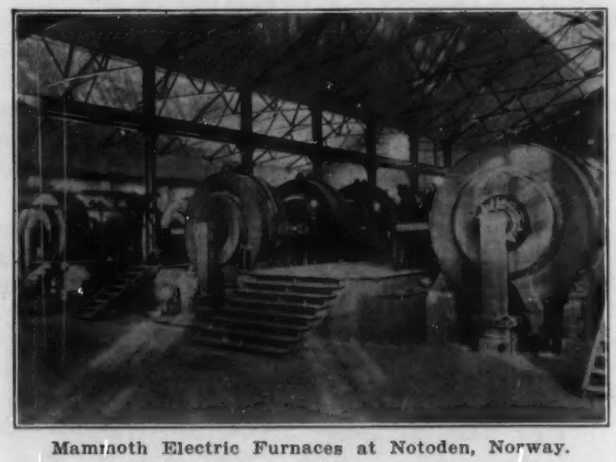
We realize that there are many other instances in the state of similar co-operation but have mentioned only the most striking examples. Also we should add that where a steam plant is not regularly operated, but held in reserve, that mill refuse is not a cheap fuel to handle.

To sum up the situation, Oregon is a wonderful power state. If power were not comparatively easy to develop we would not likely have the great over supply that is now apparent. The Portland district with about one-third the population has perhaps the greatest proportion of this excess development, variously estimated at from ten to twenty thousand kilowatts.

One of the most necessary things to do in any business is to find a market for your product. This is the power problem in Oregon today. The purchaser of current, the manufacturer, the irrigation farmer should all profit by this condition, and as a matter of fact are profiting since new industries are springing up in every direction, and the general good influence of plenty of good cheap light and power is apparent on all sides.

Our cities and towns have a progressive look to them, the electric railway communication is fast and reliable, and in every way is Oregon feeling the indirect results of this present over supply of electric current. The very fact of this condition becoming better known should do much to establish Oregon as a great manufacturing state and a great state in which to live, and in a very short time the demands of the people will absorb I am sure any present over supply of current thus returning to the far-sighted investors the money they have so liberally expended on their faith in the community.

The new developments projected at this time, all of which are more or less dependent on some local condition or allied business consist principally of the Oregon Electric Railway Company's McKenzie River plant near Eugene. A development on the Umpqua River near Reedsport in connection with paper mills proposed for that point. The Santiam Power Company project to take care of paper mills at Lebanon and the surrounding country.



Mammoth Electric Furnaces at Notoden, Norway.

Then we have the collosal Dalles Project at Celilo Falls on the Columbia River, about 200,000 kw. This is a low head development now being investigated by the National government in conjunction with the states of Washington and Oregon for which preliminary work over $30,000 is available. It is the intention to develop this great amount of power cheaply, offering it for sale to attract big industries that require large quantities of cheap electrical energy, such as for electric smelting, nitrate reduction, etc.

This proposed plant would be about eighty miles from Portland but much closer to thousands of acres of land along the Columbia River suitable for industrial purposes and with deep water shipping facilities.

Overhead distribution lines in Britain total nearly one thousand miles in length. They are alternating current ranging between 2000 and 20,000 volts, 115 miles only operating at the highest mentioned voltage. The longest existing direct transmission line is only about 20 miles in length but one of 40 miles is now under construction.

PANAMA CANAL TRANSMISSION LINE WORK

Foundations for the track-span bridges of the high tension transmission lines have been installed between Mount Hope and Diablo, and their installation is now advancing south of Diablo, along the right-of-way of what will be made the permanent main line of the Panama railroad, running into Balboa. At Corozal, their placing required the moving of two crossovers, the shifting of the spur leading to the commissary building, and throwing the temporary track south of Corozal, known as the sand line, to the west, placing it on a center of 19 ft. 6 in. from the southbound main of the Panama railroad. At Gamboa bridge, across the Chagres River, the placing of foundations is delayed by the work of erecting brackets, which are also to support the highway and foot bridge being erected by the Panama railroad on the east side of the bridge.

The erection of the track-span bridges is following closely the completion of foundations. The bridges are in place between Mindi and Pedro Miguel, with the exception of several which cannot be erected at present on account of some local interference.

The one ground-wire and three power wires which are suspended on each side of the track, have been strung between Radio Station and Pedro Miguel, with the exception of the gap at the Chagres River. The insulators are placed at about the same time the bridges are erected.

The steel work for the transformer substation at Gatun has been completed and erection of the walls of hollow concrete block has begun. The steel work at the Miraflores substation is practically completed. Filling for the site of the substation at Cristobal, east at Camp Bierd and opposite the proposed Atlantic entrance coaling plant, is in progress and the Panama railroad is making preparations for driving the piles to support the building. Bed rock beneath this area lies from 35 to 45 ft. below sea level, and the station will be supported on about 600 timber piles. Part of the foundation steel has been delivered at the site, in readiness for the beginning of building operations.

MUNICIPAL ELECTRIC LIGHT AND POWER STATIONS.

Preliminary figures of the forthcoming quinquennial report on the municipal central electric light and power stations of the United States have been given out by Director Harris of the Bureau of the Census, Department of Commerce. They were prepared under the supervision of W. M. Steuart, chief statistician for manufactures. The statistics relate to the years ending December 31 for 1912 and 1907, and June 30 for 1902, and cover municipal electric plants only. Municipal stations are those operated under the ownership of municipalities or other local governments.

As a rule, no cash income is derived by municipal stations for electrical energy used for lighting streets and public buildings, and in order that the income shown may approximate the total consumption and sale of electric current by these stations the schedule required that the income for service of this character should be estimated on the basis of what would have been charged for similar service by commercial companies in near-by localities. The number of persons employed may fall short of the total number actually engaged in work in connection with the operation of the electric stations, because the services of employes for the electrical work often are not required for long or continued service, and they are reported with that branch of municipal work with which they are chiefly employed.

The figures as presented for the United States show substantial gains for the decade 1902-1912. The number of stations increased from 815 in 1902 to 1562 in 1912, or 92 per cent. The total income for 1912 amounted to $23,218,989 as compared with $6,965,105 in 1902, or an increase of 233 per cent. The total expenses for 1912 amounted to $16,917,165 as compared with $5,245,987 in 1902, or an increase of 222 per cent. The total number of persons employed numbered 7940 in 1912 as compared with 3417 in 1902, or an increase of 132 per cent. The plants had a total of 559,328 h.p. in 1912 as compared with 160,028 h.p. in 1902, or an increase of 249 per cent; the capacity of the water wheels having increased from 11,218 h.p. in 1902 to 130,261 h.p. in 1912, or 1061 per cent. The output of stations in 1912 was 537,526,730 kw.-hr. as compared with 195,904,439 kw.-hr. in 1902, or an increase of 174 per cent. The estimated number of arc lamps wired for service was 91,851 in 1912 as compared with 50,795 in 1902, or an increase of 81 per cent. All other varieties of lamps wired for service, however, numbered 7,057,849 in 1912 as compared with 1,577,451 in 1902, or an increase of 347 per cent. There was an increase of 310 stations in 1912 as compared with 1907, accounted for as follows: New stations, 301: From commercial to municipal stations, 106; from municipal to commercial, 80; and 17 stations reported in 1907 that were out of business or not in operation in 1912.

The figures are shown in detail in the accompanying table:

Municipal Light and Power Station Statistics.

	1912.	1907.	1902.	Per cent of increase: 1902-1912.
Number of stations....	1,562	1,252	815	91.7
Income	$23,218,989	$14,011,999	$6,965,105	233.4
Electric service, (light, heat and power, including fire service)	$22,663,708	$13,614,434	$6,836,856	231.5
All other sources..	$555,281	$397,565	$128,249	333.0
Total expenses, including salaries and wages	$16,917,165	$10,316,620	$5,245,987	222.5
Total number of persons employed	7,940	5,566	3,417	132.4
Total horsepower	559,328	321,351	160,028	249.5
Steam and gas engines (including turbines):				
Number	2,307	1,792	1,078	114.0
Horsepower	429,067	289,500	147,975	190.0
Water wheels:				
Number	269	153	82	328.0
Horsepower	130,261	30,347	11,218	1,061.2
Auxiliary engines:				
Number	[1]	72	36	.....
Horsepower	[1]	1,504	835	.....
Kw. capacity of dynamos	368,677	209,016	113,380	225.2
Output of stations, kw.-hr.	537,526,730	289,462,788	195,904,439	174.4
Estimated number of lamps wired for service:				
Arc	91,851	[2] 82,940	50,795	80.8
All other varieties	7,057,849	[2] 4,061,318	1,577,451	347.4
Stationary motors served:				
H.P. capacity	164,291	31,689	3,324	4,842.6
Number	21,895	4,507	1,962	1,016.0

[1] Not reported separately.

[2] Includes, for purposes of comparison, 595 arc and 28,579 incandescent lamps reported by the electric companies to light their own properties. Lamps used for such service were included in the total number reported in 1912.

LIGHTING METHODS

DESIRABLE QUALITIES OF ILLUMINATION.

BY G. H. STICKNEY.

(In this article the author discusses the limitations attendant upon securing the best possible illumination and the compromises which must be made that the system designed shall be most satisfactory for the purposes desired. Mr. Stickney is assistant sales manager, Edison Lamp Works of General Electric Company, Harrison, N. J.—The Editors.)

To provide suitable artificial illumination for any room or street, or for any purpose, it is necessary to do more than project a quantity of light into space. This seems self-evident, yet there are many installations where apparently little consideration has been given toward achieving the best possible results. Such failures are undoubtedly due to a lack of realization of the desirable qualities of illumination and the manner in which they are produced.

This brings up the natural question: "What are the desirable qualities of illumination?" to which we may give the answer: "For what purpose is it to be used?" In general, there are certain qualities which are desirable for almost any ordinary use; on the other hand, each particular use to which a space may be put, in a degree, modifies the most desirable requirements.

In almost every case the result is obtained by a compromise. For example, we compromise in economy in order to insure a reasonable degree of diffusion. Moreover, the compromise is different in different classes of installations, depending upon the importance assigned to the various qualities. It is obvious that in some cases the demands of economy outweigh those of diffusion; while in others, a good degree of diffusion is of paramount importance. In other words, the test of good illumination is not only the presence of the desirable qualities, but a proportion or balance suited to the particular requirements.

Let us list some of these desirable qualities common to ordinary installations:

(1) Intensity, (2) diffusion, (3) direction of the light, (4) distribution, (5) color of light, (6) its steadiness, (7) reliability, or continuity of service, and (8) economy.

You will note that these qualities are those of illumination, and do not include the important characteristics of lamps and equipments, though they are often the determining consideration in selecting the system of lighting. Such questions, for example, as the convenience of maintaining lamps, do not come within the province of this article.

Intensity.

Intensity is placed at the head of the list. It is the quantitative element and, all else being equal, is the measure of the cost. While it is the most important single consideration, it must be remembered that good illumination is not determined by intensity alone.

In artificial lighting the values run much lower than they ordinarily do in daylight. Our eyes can adjust themselves to a wide range of intensities, so that we have a tendency to economize in the cost of lighting by approximating the lowest intensity permissible. With the intensities ordinarily employed in artificial illumination, we find that we can see detail better and more quickly with higher intensities than with low. Here is where we begin to compromise. If we can sacrifice detail and do not need to see quickly, we can get along with a relatively low intensity of illumination. In manufacturing, however, the increased speed and sureness of the workman obtained with higher intensity, makes the cheaper, low intensity illumination extremely extravagant.

How shall we determine when the relation between the cost and intensity shows the best results? In general, we have to depend upon the practice of today. For example, dry goods stores in a large city use five to eight foot-candles on their main floor sales rooms, with lower intensities (falling to about three foot-candles) on upper floors. This will serve as a guide for other stores, who must use light in corresponding proportion to their requirements.

In manufacturing, where the commercial element does not enter, we may use general practice as a guide or we may make a study of the particular requirements of certain processes. Probably the most extensive intelligent effort to study the intensity requirements of manufacturing processes are those made by the steel manufacturers. They ran a long series of experiments for each of their processes, to determine the minimum and most advantageous intensities of illumination. Changes were made in the working illumination and the results noted. When critical points were determined the illumination was measured and the practice standardized. (See Proc. Iron & Steel Electrical Engineers, Fifth Annual Convention, New York, Sept., 1911.)

Diffusion.

Much is now being said and written regarding the deleterious effects of glare. These have become more and more serious with the development of high efficiency units, with their correspondingly higher intrinsic brilliancy.

In all of our practical light sources, the illumination proceeds from a relatively small point or line which is of such brilliancy as to produce an unpleasant, or even injurious blinding effect if we look directly at the unshielded source. Our eyebrows ordinarily protect the eyes from glaring sources located high above the head; as, for example, the noon-day sun, but glaring lights on or below the line of vision are particularly disagreeable. The glare not only prevents our seeing other objects, but may produce actual injury to the delicate apparatus of the eye.

The construction of our buildings, as well as the dictates of economy, usually require illuminants to be hung rather low. In such a case it is desirable to reduce the brilliance of the light by means of diffusing globes, shades or reflectors which apparently enlarge the light source, making it more agreeable to the eye.

Diffusion, however, contributes a further aid to seeing. Light proceeding from a point or line, cuts sharp, distinct shadows when intercepted by objects, so that harsh contrasts are likely to appear in the illumination. Diffusion, by introducing cross rays of light, produces what artists call transparent shadows, with pleasantly grades fringes.

On the other hand, we do not want to go to the other extreme and entirely eliminate the shadows, which are really very useful in bringing out the contour and shape of objects. This over-diffusion, or flat illumination, is trying to the eyes and very unpleasant.

Diffusion is almost invariably obtained at a loss of economy, since some light is absorbed by the diffusing surfaces. The practice is, therefore, more inclined to lean toward glare than over-diffusion. Dull-surfaced, light-colored walls and reflectors, as well as translucent shades and globes, are principal contributors to diffusion and should be judiciously utilized. The use of sand-blasted or frosted glass or rough reflecting surfaces should be avoided in places where oil and dust are likely to accumulate. The rough surfaces not only form lodging places for light absorbing material, but also are harder to clean than smooth surfaces.

Direction.

It seems to be a perfectly simple proposition that the light should fall upon the objects to be seen, and not directly on the eye. And yet, how many installations are made without considering this point.

The worst and most obvious faults are observed in window lighting, where it is such an easy matter to conceal the lamps and direct the light upon the merchandise to be shown. In some cases, of course, windows are lighted to attract attention rather than to show goods, but in general an attractive display of merchandise is the object of window lighting.

In ordinary installations it is generally impracticable and undesirable to conceal the light sources. But much can be done by locating the sources and directing the light to produce a desirable effect. It is generally advantageous to have the lamps high and out of the line of vision. Lamps can be equipped with reflectors to direct the light downward to the working plane. But cutting off, or diffusing the light through angles near the horizontal, the glaring light can be kept out of the eyes.

Very often rooms have natural illumination centers, from which the illumination can be most conveniently distributed. In a store, while general illumination is required on all surface, the shelves and counters require the most particular illumination.

In manufacturing, familiarity with the process is necessary to tell where the light is most particularly required. For example, with a lathe the principal illumination is required at the tool point, and, to prevent shadowing, it should come from the front and, if possible, the right. In almost all cases the light should come from above.

Distribution.

There are two extremes of practice in regard to the distribution of light, which are known as general illumination and local or localized illumination.

With general illumination an attempt is made to provide a relatively even intensity of light throughout a room, irrespective of the location of machines, counters or furniture. With localized illumination, a light is provided just at important points, falling off to low values in the intermediate spaces. General illmination stimulates daylight, produces the best appearance, and is independent of changes in arrangement of tools, etc. Local illumination usually requires less light flux, especially if work is scattered. It permits the illumination to be adjusted to most special requirements.

When carbon incandescent and arc lamps were the principal sources of illumination, the line between general and local illumination was quite distinct. Since the Mazda lamp has provided an efficient unit with a wide range of available capacities, it has been possible to provide illumination having the most desirable features of both. For example, a relatively even illumination can be provided, with the lamps so arranged as to give a slightly higher intensity at the most important points.

When it is necessary to see up under a low machine or in a deep boring, a small portable lamp is still required. In a high crane bay, the best effect can be obtained with large units or groups of units hung high. In the majority of cases, however, the moderate sized unit gives the best effect. When too small a unit is selected, too large a number have to be used, thus increasing the cost of fixtures and wiring, as well as lamp maintenance. Moreover, in extreme cases, the appearance of such an installation is very poor. On the other hand, if too large a unit is selected, it is not possible to obtain a sufficiently even distribution of light, or the light cannot penetrate around obstacles, so as to avoid excessive shadows. Very often in industrial lighting, it becomes necessary to use smaller units in order to avoid shadows from high machinery.

(To be continued.)

The average peak lighting and power load at the Panama-Pacific Exposition is estimated at 8500 kw.

The formation of an oxidizable nitrogen by the combined action of a so-called "silent" discharge and a "spark" discharge in air at atmospheric pressure was shown in a series of photographs presented by Dr. T. Martin Lowry at the November meeting of the Faraday Society. The Electrical Review (London, Eng.) reports that the observations arose out of experiments made with gases for bleaching flour. The new allotropic variety of nitrogen has the property of being oxidized by ozone to nitrogen peroxide. If no ozone is present the gas quickly reverts to the ordinary form. The existence of this allotropic nitrogen may have some bearing on the technical fixation of nitrogen, and it is suggested that the oxidizable variety is first formed by the discharge and afterwards oxidized by means of the ozone formed simultaneously to the oxides of nitrogen. The chemically active variety of nitrogen recently discovered by Strutt under certain conditions of vacuum discharge would appear to be different to Dr. Lowry's variety, as it is not oxidizable by ozone.

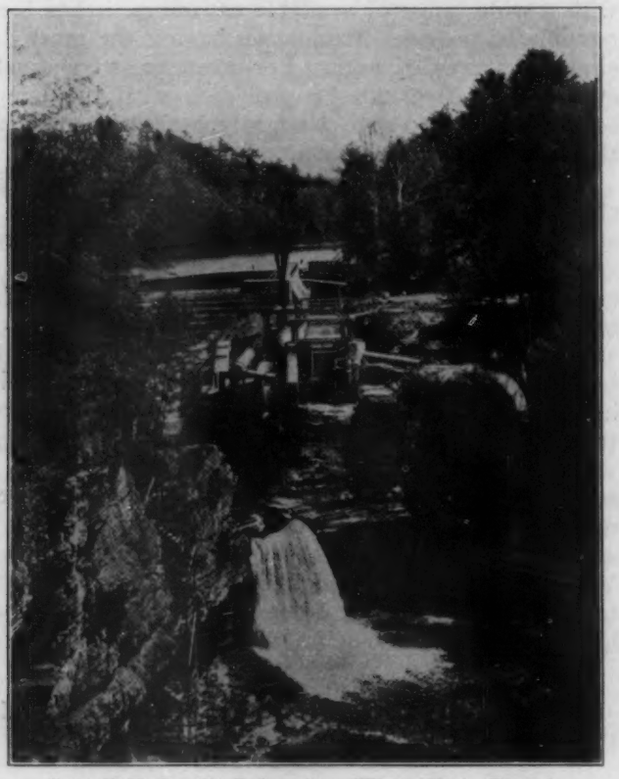
A WEIR PROBLEM.

BY BEN D. MOSES.

It is required to design a dam, or weir, to carry 200,000 sec. ft. of water and the maximum head over the crest is not to be greater than 15 ft.

The ordinary weir formulas which are based on the fundamental expression $Q = cbh^{3/2}$, where **c** is a coefficient determined by experiment, **b** is the length of the weir in feet and **h** is the head on the weir in feet, are unsatisfactory for the reason that the coefficient varies between rather wide limits and because it has been determined for only a limited range.

Bazin, Francis and Feeley and Stearns pioneered the work, and acting on their results Mr. G. A. Rafter obtaining the co-operation of the U. S. Board of Engi-



Cornell Hydraulic Laboratory Where Weir Experiments Were Conducted.

neers on Deep Waterways, and the use of the Hydraulics Laboratory of Cornell University, ran a series of tests duplicating the Bazin Series' Sections as nearly as possible. For details, tabulated results and curves of these, the reader is referred to Trans. A. S. C. E. Vol. 44, and U. S. G. S., W. S. and I Paper, No. 200.

All of the above experiments were performed on a weir of about 6.5 ft. length, and for heads ranging between .1 and 6.0 ft. and the coefficients can be used, with confidence, within these limits—the extended use, however, is more or less doubtful.

Prof. J. N. LeConte suggested, in his article "Flow Over Model of Sunol Dam," Engineering Record, Aug. 16, 1913, that the use of formulas might be discarded and the flow computed by actually calibrating a model of the dam in question. Or, he contends, if a model be made such that all the linear dimensions are proportional and are 1/**n** that of the corresponding linear dimensions of the actual dam, then the quantity over the actual dam will be $n^{5/2} \times$ that over the model, or $Q = n^{5/2}q$. This takes it that the coefficient **c** is the same for all similar dams or weirs, all of whose linear dimensions are proportional, or expressing it in symbols,

$q = cbh^{3/2}$ for the small weir or model.

$Q = cBH^{3/2}$ for the actual weir or dam.

but if $B = nb$ and $H = nh$

then, $Q = c\,(bn)\,(nh)^{3/2} = cbh^{3/2}n^{5/2}$

or, $Q = qn^{5/2}$.

Before attempting the direct application of the above principle, let us examine its precision when applied to an actual model. For this purpose I have chosen the section and data found in the Cornell Series of Experiments on the Croton Dam, W. S. and I. paper No. 200, p. 91 and 95. (See Table 1.)

In each case the lowest obtained head (**h**) is used as a unit and the discharge considered as that of a model one foot long with this head over its crest. The heads (**H**) considered then in each case determines the factor **n** as $\frac{H}{h}$, and the length results as $\frac{H}{h}$ feet, the quantity will be $\frac{H}{h} \times$ the tabulated experimental quantity this is then compared with the quantity as found by $q \times \left(\frac{H}{h}\right)^{5/2}$

It is interesting to note that the error with two exceptions is less than 2½ per cent and with three exceptions less than 2 per cent. These errors come rather consistently on points that, if compared with the curves on p. 95 W. S. & I 200 will be found to be also slightly in error. Possibly if a quantity head curve had been accurately plotted for each model this error would have been diminished. Various authorities on the subject of weirs consider the experiment as being within 2 per cent of being correct.

Now for the extension of the principle.

Fig. 1 shows seven different sections, their corresponding coefficient head, and quantity head curves, as taken from the Cornell Series of experiments. (Trans. A. S. C. E. Vol. 44. pp. 267 to 281) and W. S. & I. No. 200, p. 88.) The limiting head obtainable in each case was, however, less than 6 ft. and the length 6.58 ft.

The curves were plotted carefully and passed through the points accurately, and assuming that the curve becomes a straight line from 6 ft. on the quantity per foot was obtained at a head of 15 ft. for each section, call it **q'** then the length necessary to carry 200,000 sec. ft. would be $200{,}000 \div q' = L$. The section No. 1 and No. 2 give the greatest **q'** or least **L**. $q' = 194$ sec. ft. — $h = 15$ ft., $L = 1032$ ft. This assumes a constant coefficient from 6 ft. on up which may or may not be true.

Now consider the problem from the other point of view (see Table 2). The columns headed **h** and **Q** per ft. are taken directly from the experiment as tabulated; the column **H** is the head over the proposed dam or 15 ft.; the column Ratio **n** is obtained by considering the 1 ft. model with its head **h** and en-

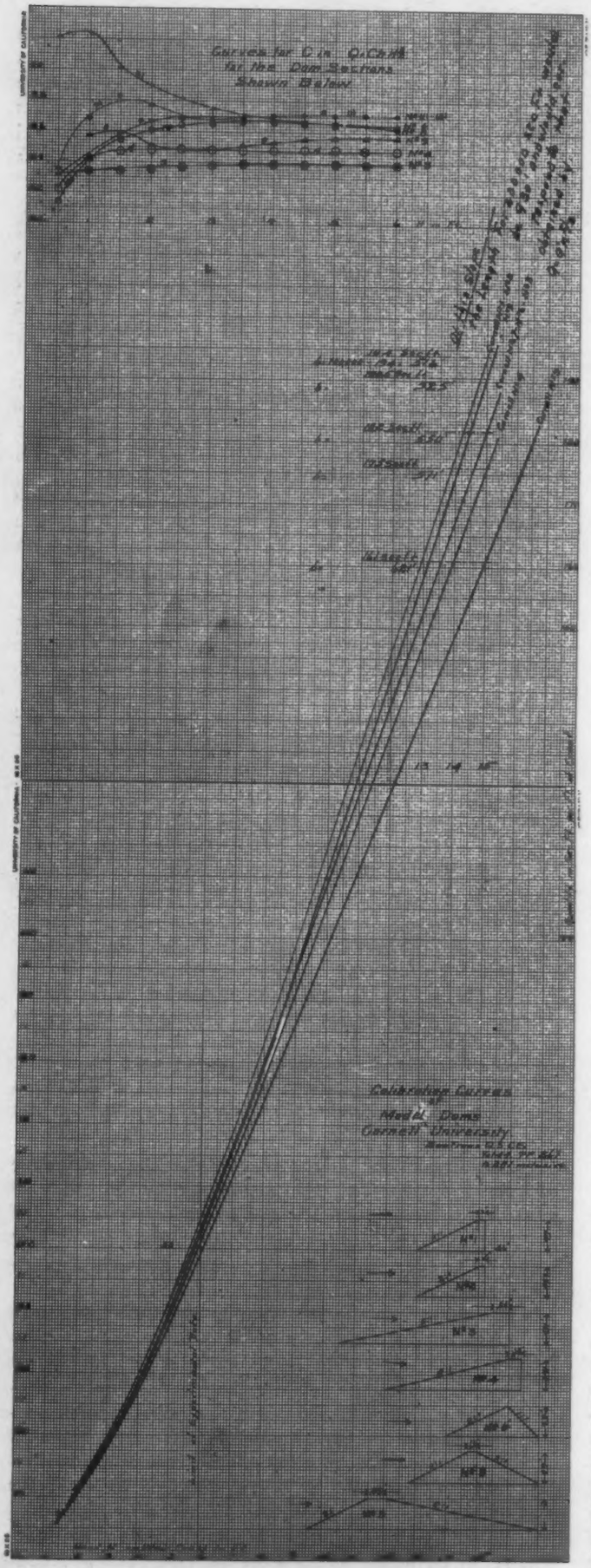


Fig. 1.
Comparison of Different Water Power Fees Charged by the Departments Having Jurisdiction.

$\frac{H}{h}$ larging it **n** times or — times; it also is the length of

the model; the column headed **Q** shows the quantity flowing over the model **nh** feet deep and **n** feet long, and is found by $Q = qn^{5/2}$; and finally the last column is the length of the proposed dam to carry 200,000 sec. ft. 15 ft. high.

Computations for the Quantity Over a Model Dam by the Proportional Method vs. Direct Experiment.

TABLE 1.

	Head taken as Unit q.	Corrected Head on Weir h.	n—H/h.	Tabulated Q per 1 ft. Discharge for n—5/2	Experimental Discharge H.	Computed Discharge =Qxl.	Q=qxn—5/2	Error Per Cent.
h=	.5907	2.7668	4.683	47.46	14.672	69.2	68.8	—0.58
		2.2116	3,744	27,12	10.562	39.6	39.4	—0.51
q=	1.451	1.4475	2.450	9.39	5.604	13.71	13.52	—1.3
		.9861	1.665	3.57	3.222	5.36	5.19	—1.3
h=	.6305	2.1046	3.337	20.34	9.578	31.91	30.40	—1.6
		1.8395	2.917	14.53	7.883	23.00	21.75	—5.4
q=	1.494	1.5946	2,529	10.17	6.284	15.90	15.20	—4.4
		1.2596	1.997	5.636	4.287	8.56	8.42	—1.6
		.9947	1.577	3.123	3.030	4.78	4.67	—2.3
h=	.4877	2.9753	6.100	91.90	16.475	100.40	99.90	—0.5
		2.9091	5.964	86.80	15.969	95.20	94.40	—0.84
q=	1.087	2.5305	5.188	61.31	12.933	67.10	66.60	—0.75
		2.1661	4.441	41.56	10.211	45.40	45.20	—0.44
		1.6358	3.354	20.60	6.740	22.60	22.40	—0.91
		1.2657	2.596	10.86	4.548	11.80	11.80	—0.00
		1.1465	2.351	8.475	3.913	9.21	9.22	—0.10
		.7209	1.478	2.650	1.945	2.874	2.88	—0.20
		.4877			1.087			
h=	.4251	2.0187	4.748	49.10	9.037	42.85	42.20	—1.50
		1.4129	3.323	20.13	5.308	17.65	17.32	—1.8
q=	.861	.8656	2.036	5.915	2.527	5.145	5.09	—1.07
		.4251						

TABLE 2.

h.	Q per ft. of Model Crest.	H on Proposed Dam.	Ratio $m=\frac{H}{h}$	q Over Unit length of Model Crest. $m-\frac{5}{2}$	Q over Enlarged Model	Length at Dam L.
1.0	3.44	15	15.00	871.0 × 3.44	=3000	1000
1.5	6.59	15	10.00	316.0 × 6.59	=2081	960
2.0	10.66	15	7.50	154.0 × 10.66	=1641	914
2.5	14.59	15	6.00	88.2 × 14.59	=1286	934
3.0	19.13	15	5.00	55.9 × 19.13	=1070	934
3.5	24.25	15	4.29	38.0 × 24.25	= 923	930
4.0	29.68	15	3.75	27.2 × 29.68	= 807	929
4.5	35.40	15	3.33	20.28 × 35.40	= 719	929
5.0	41.46	15	3.00	15.59 × 41.46	= 646	930
5.5	47.85	15	2.725	12.30 × 47.85	= 588	928
6.0	54.54	15	2.50	9.80 × 54.54	= 535	934

The average for all, excepting the first three is 931, and the greatest variation is about .3 per cent. The coefficient curve (Fig. 1.) shows also an inconsistency for these points.

Now this is 1032 — 931 = 101 ft. shorter dam than is obtained by extending the curves. (Fig. 1.)

The heavy broken line on Fig. 1 shows where the curve must go to obtain this last result, and which position could be easily and quite reasonably obtained by slightly curving the extend curves.

The use of the telephone in China is limited, though the Chinese take to the telephone with extraordinary readiness. Modern interurban communication by telephone is almost unknown, the only exception being the line between Peking and Tientsin and several small lines used in connection with the dispatch of railway trains. Local telephone exchange systems are found only in Peking, Tientsin, Shanghai and Canton. They are government owned and are operated as a part of the telegraph system. The number of subscribers is not available, but the exhanges are small.

WATER POWER LEGISLATION

NEW AND PROPOSED REGULATIONS AFECTING WATER POWER DEVELOPMENT.

BY L. F. HARZA.

[Concluded.]

The individual states have always claimed, through state charter provisions, the jurisdiction over non-navigable streams. The Department of Agriculture, however, through ownership of the forest reserves, is able to, and does dictate terms to control power development on the reserves. The result is that anyone wanting to build must conform to two sets of regulations, paying filing fees and annual fees to both the state and Federal government. The form of Federal permit which has heretofore been issued has had a life of fifty years, but has been revocable at the discretion of the Secretary of Agriculture, without provision for compensation. The Congressional act which conferred upon the Secretaries the power to grant permits explicitly required that all such permits should be so revocable.

The new "National Forest Manual," under date of February 24, 1913, however, indicates that this authority, although expressly granted to the Secretary by Congress, has now been modified by him in such manner that revocation will be made only upon failure of permittee to comply with the terms of the permit.

In the case of water power rights on the public domain, outside of the forest reserves the Secretary of the Interior has jurisdiction. Since the wholesale withdrawal from entry, a few years ago, of public lands controling power sites, no definite policy has ever been decided upon for their disposal, unless the recent permit issued jointly by the Secretary of the Interior and the Secretary of Agriculture, in the case of the International Power and Manufacturing Company, on the Pend d'Oreille River, may be considered as establishing a precedent to be followed in the future, by the Department of the Interior, if not also as initiating a change of policy by the Department of Agriculture.

A comparison of the fees established by this permit with those of the Forest Service may be of interest to some present. I will assume for the purposes of illustration a power site offering a net fall of 125 ft. and a "nominal" flow of 1000 sec. ft. of water as defined by the "Manual" to be the "flow determined by averaging the values estimated for the natural mean flow for the two-month minimum flow period in each successive five-year period or major fraction thereof," plus any increase made available from storage by other than project works.

From this power site there would be available a theoretical continuous horsepower of 14,200, or a power capacity as defined by the "Manual," which assumes about 70 per cent station efficiency, of 10,000 horsepower. The "Manual" provides that fees be paid upon only such part of this capacity as is practically available for transmission as based upon load factor and forebay storage. The basis of arriving at power site capacity as defined in the new contract on the Pend d'Oreille River, has been copied verbatim from the "Manual" of the Forest Service.

In regard to fees or compensation for the permit the two regulations differ radically. The Forest Service requires a payment in advance of ten cents per horsepower of site capacity at time of filing (same to cover the first year license fee), twenty cents the second year, thirty cents the third year, and similarly until the fee of one dollar is reached in the tenth year, and applied to all succeeding years. These fees are payable from the date of preliminary permit, but are discontinued after the date of commencement of operation for a period equal to that for which fees were paid during survey and construction. The whole regulation seems to have been framed with the idea of preventing speculation in power sites and to discourage applications for permits except by bona fide developers and not by them until nearly ready to develop.

On the other hand, the terms of the Pend d'Oreille contract indicate a much different viewpoint on the part of the new Secretaries. The permittee pays no fees whatever for the first ten years and his fees are then dependent upon his average selling price of energy and upon the proportion of the capacity of the power site then developed, increasing directly as the square of the former and inversely as the square of the latter. The evident purpose is to make it as easy as possible for the project to get on its feet by waiving the fee during the development period of the enterprise, while at the same time encouraging the ultimate full utilization of the site at a low cost to the consumer. The price of energy to the ultimate consumer is limited to two (2) cents per kw.-h. for a consumption of 2000 kw.-h. per year or more at a load factor of 35 per cent or greater, and to six (6) cents per kw.-h. for smaller consumers.

In basing the compensation upon the "average selling price of energy" this average price is defined by the permit to be "the total actual and estimated annual receipts from the sale and disposition of electric energy divided by the total number of kilowatt-hours generated." Since the energy generated is considerably greater than that sold, the price arrived at in this manner is really lower than the actual rates to the consumer.

The permit is indeterminate during compliance with the terms thereof, but may be revoked by the Secretaries for non-payment of fees or other breach of contract and is subject to revisions at intervals of not less than twenty (20) years to conform to then existing regulations.

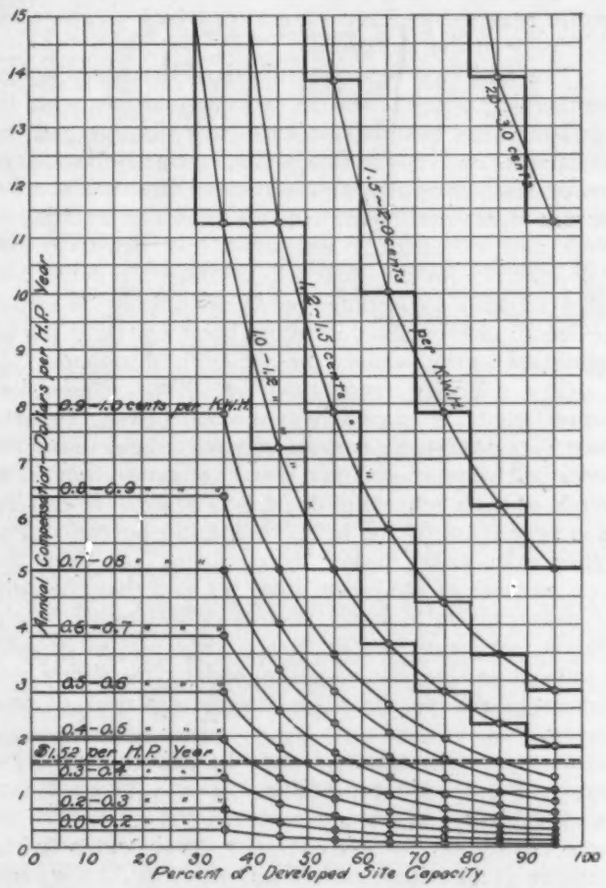
Provision is made for transfer to municipal, state or Federal government at a price to be agreed upon by the parties in interest or by condemnation.

Speculation in power sites is intended to be prevented by a clause in the permit which requires project works to be begun within one year and completed within three years, to the extent of a machine installation rated at 50,000 h.p. or more, which is about 45 per cent of the site capacity of 112,000 h.p.

To arrive at a method of comparing the compensation required under the Forest Service standard contract and under the new joint contract, it must be re-

membered that the former requires payment of fees from the beginning, while the latter waives all compensation for the first ten years. For this reason I have added to the first ten years' actual accumulated fees under the Forest Service permit, compound interest at six per cent upon money so invested up to the time when payments begin under the other permit. This actual payment of fees during the first ten years amounts to five dollars and fifty cents ($5.50) per h.p.) and when compounded at six per cent amounts to seven dollars and twenty-one cents ($7.21) per h.p., thus adding a "going value" of this amount to the capital investment when compared with the other contract.

To make the two fees comparable it will be necessary to add to the former an annual sinking fund assumed to earn three (3) per cent interest and sufficient to replace the first ten (10) years' fees during the remaining forty years of the life of the permit. What may be designated as the "effective annual fee" for the Forest Service permit will then be constituted as follows:



Actual annual fee per h.p.	$1.00
Six per cent of $7.21	0.432
Forty year 3 per cent sinking fund to replace $7.21	0.093
Total	$1.525

On the accompanying diagram the vertical scale represents the annual fee in dollars. The horizontal scale represents the developed proportion of the site capacity and one curve is drawn for each value of the average selling price of energy as defined by the recent contract. These curves should really all be stepped lines as shown in three instances, since the same rate applies from 60 to 70 per cent, 70 to 80 per cent, etc., of developed site capacity. They are drawn as curves through 65. 75 per cent, etc., to avoid confusion of lines.

It is altogether likely that any generating station, the construction of which was originally justified, would be nearly if not entirely loaded up at the end of ten years, thus warranting a completion of structures and machine equipment for the entire site capacity. It should be noted that the fee is based not upon the proportion of the site capacity which is being utilized, but upon the proportion which the permittee is equipped to supply. Thus in most instances only the right edge of the diagram is of much significance.

In this diagram, the heavy dotted line represents the "effective" Forest Service fee of $1.52 per annum, which is constant regardless of per cent of developed site capacity or selling price of energy.

It will be noted that for complete development (95 per cent on the diagram) the energy rate of 1.1 per kw.-h. calls for the same fee under both contracts. For greater prices of energy the fee increases very rapidly, under the new contract, becoming $11.25 per h.p.-year for a price of 2.0 to 3.0 cents per kw.-h. For energy prices below 1.1 cents the fee under the new contract reduces very rapidly to that of 11 cents per h.p.-year for selling prices of about $13 to $20 per continuous h.p.-year, which may be considered as including the range of prices practicable for electrochemical service and to five (5) cents per h.p.-year for still lower prices.

It is rather surprising that the permit in thus making the fee dependent upon the average selling price of energy does not specify in any manner the nature of the service, distance from the point of generation, load factor or any other of these several conditions which must be taken into consideration in judging the charge for energy. Thus it is well known to those in the business that a price of five to ten cents per kw.-hr. to a small consumer for lighting service need not necessarily represent any greater earning on the investment than a wholesale price of one cent or less nearer the place of generation.

This form of permit will surely have the revolutionary effect of separating the business of generation from that of distribution. In such case the permit explicitly prohibits the permittee from having any financial interest whatever in the other company otherwise the fees under the permit will be based upon the ultimate price to the consumer.

In the "Middle West" Wisconsin has just passed through an experience in experimental water power legislation and judicial review which has attracted wide attention particularly through that section of the United States where the riparian rights doctrine is thoroughly established. The Wisconsin legislature in 1911 undertook to repeal all private and local laws granting water power rights both developed and undeveloped and to practically remove all title to water rights from riparian proprietors and vest such rights in the state, subject to use by individuals or corporations under lease from the state. On January 30, 1912, the Wisconsin supreme court declared this law unconstitutional and held the right to develop power to be "unquestionable a private right appurtenant to the riparian land."

The necessity (heretofore) of going to the legisla-

ture for a franchise to obtain the right of eminent domain, together with the necessity of incorporation through state authority makes possible the dictation by the state of terms of development even though such development may be "unquestionable a private right appurtenant to the riparian land."

The new law (Chapter 755, Laws of 1913) passed since the above decision, avoids declaring the power to be the property of the state, but accomplishes the same purpose by the terms imposed upon its development. The entire authority of granting franchises of thirty (30) years duration, approval of design, construction and expenditure of funds, approval of all power contracts, supervision of maintenance and operation, auditing of accounts, regulation of rates, appraisal of values for this purpose or for purchase by municipality or state, is by the act entrusted to the state railroad commission. This commission is by the act authorized to assess all owners of dams now or hereafter constructed, an annual inspection fee not to exceed ten cents per theoretical horsepower to cover the expense of thus supervising the dams of the state. The railroad commission of Wisconsin has thus been given administrative and judicial powers similar to, but far greater than those of the Oregon water board.

One of the noteworthy features of the bill is that, in the regulation of rates and in the event of purchase by the public, the value to be assigned to the lands constituting the power site shall be the value as land only, without any increase because of its adaptability for power purposes and that this appraised value shall in no case exceed the price originally paid by the permittee for these lands. This provision is contrary to all precedent. In the appraisal of public utility properties of all kinds by the various regulatory bodies it has always been assumed as self evident, so far as the speaker is aware, that lands belonging to and useful to the utility as building sites, right of way, etc., should be allowed to appreciate with the values of surrounding property.

Another provision decidedly vicious in character is that "The legislature reserves the right to at any time alter, amend, or repeal any and all franchises granted under this section." If there is any probability that a court would hold this clause to be constitutional, all future development of water power in Wisconsin has been effectually prohibited.

In New York state the further development of water power is said to be going slowly, largely because of the failure of the legislature to recognize the development of water power as a public use, for which the right of eminent domain can be granted, and the failure of the people to amend the constitution if necessary, to authorize its granting for this purpose.

One organization, the "National Conservation Congress," deserves special mention because of its present influence in moulding public opinion upon water power matters. The water power committee of this "congress" at its last annual meeting in November, 1913, was unable to agree upon some of the important questions under consideration. In the interest of progress however, a unanimous report was made covering such principles as could be agreed upon and majority and minority reports were presented relative to disputed points.

It is very gratifying to note especially from the majority report, that the conservation congress as a whole is receding from the position of extreme radicalism which has largely characterized the conservation movement heretofore.

Thus even the unanimous report comes out with the recommendation that "For a definite initial period, sufficient to be financially attractive to investors, the privilege should be irrevocable except for cause reviewable by the courts."

Further recommendations of the unanimous report provide for: subsequent revocation of privilege by payment of physical value; revision of terms of permit every ten years after initial period; assignment of privilege only upon consent of the granting officer; the right to receive compensation for the privilege in the form of a small annual fee until net profits exceed a certain reasonable percentage after which to share increasingly in the net profits.

The majority report emphasizes the necessity of encouraging development in every reasonable way, recognizing that past regulations have discouraged development, and maintaining very properly that true conservation as applied to water power unlike other resources means maximum use and consequent saving of other and exhaustible resources. It declares that hydroelectric development is essentially monopolistic and preferably so, because of the advantages in better service to the public. It looks upon effective public regulation as the remedy for the evils of monopoly.

The minority report on the other hand cites the fact that the great power interests have in recent years increased their control of power, held in an undeveloped state, more than twice as fast as they have increased their control of developed power. It emphasizes very strongly the belief that water power control rather than water power development has been the main purpose of the power interests and that the fight for conservation of water powers is first of all a fight against monopoly, and against the speculative holding of unused powers, implying the inadequacy of rate regulation to relieve the objectionable features of monopoly.

By way of summary it may be said that most recent and proposed regulations have a decided tendency toward a closer government supervision of all the activities of a power company, as to water rights, issuance of securities, sale of power, etc. At the same time these regulations are tending toward greater definiteness in the granting of rights, which is of interest to the operating company.

It may not be out of place to offer a suggestion, at this time, that engineers take a more active part in moulding public opinion on such matters where they are especially qualified to do so. Reform organizations are largely composed of the radical type and must necessarily be so as it usually requires either that all-controlling fire of the fanatic, or a personal motive in the form of political aspirations, to stir the average human nature into active reform work. Allied against them will be those with opposite personal interests working less openly to control the course of legislation. The average disinterested citizen of intelligence will vote perhaps in the proper judicial frame of mind, but otherwise exert little influence.

LETTERS TO THE EDITOR.

Issue Taken on Relationship Between Public and Utility.

Dallas, Texas, March 12, 1914.

Sir:

Referring to the article on "Public Policy of Public Utility Corporations" in the March 7th issue of your journal, and also to your leading editorial on "A Public Policy of Publicity," I do not believe that many of us will agree with Mr. Coleman in his "first principle" of a public utility being a "tenant." As stated by Mr. Coleman, he considers that the public utility is a tenant because it "uses the property, subject to practically any order of the public, * * * and as such a tenant it is evident that our first duty is an accounting of our stewardship." Here Mr. Coleman confuses the idea of a tenant with that of an agent and brings himself in line with Commissioner Max Thelen, who is desirous of forcing the relationship existing between the public and the public utilities into one of "principal and agent."

Mr. Coleman must ackuowledge that if the public utility were merely a "tenant" of the public, that public, as a landlord, could not ask anything more than the carrying out of the original agreements made between the two as landlord and tenant, and it certainly is not within the province of any landlord, in a republic, to ask from his tenant, as a tenant, the information which the public attempts to exact from the public utility, nor to constantly endeavor to exact from that tenant dues, payments and relations which were not either stated or implied in the original agreement. Also, in the last sentence of his second paragraph he changes into the form of "a tenant serving its master (the public) under a contract (franchise)," and thus adds to the confusion of ideas. It would seem, therefore, that Mr. Coleman's "first principle" in this matter is one to which none of the public utilities will assent, and it is only a few of the extremists, like Mr. Thelen, who would claim that the fundamental relationship existing between the public and its untility was that of principal and agent, and, decidedly, there is no basis for Mr. Coleman's claim that the relationship is one of either landlord and tenant of "master" and "tenant" (servant?).

The most reasonable exposition of the real relationship existing between the public and its public utilities is that by Mr. I. F. Dix, in your issue of December 27, 1913, in which he endorses the idea that the relationship is that of "partners." This is absolutely true as regards all of the minor and local public utilities up to within the last year or so. While it may be said that in a great many of the cases the public was a "special" partner in that it had certain rights and privileges in the partnership to which the other partner or partners were not parties, this does not alter the fact that the real relationship was that of partners in a firm, or copartnership, similar to that existing in private mercantile and manufacturing businesses.

With the conclusions derived by Mr. Coleman from this untenable "first principle" there is no quarrel among any of us, except that a great many of us believe that we should not only educate the public as to what we are doing and be absolutely open with them in all matters, but we should go further than this and educate the public as to the actual rights of the public utilities, many of which rights have been lost sight of in recent discussion and many of which have been trampled on, lessened, abrogated, or virtually annulled in the recent war on the public utilities.

I am writing this because I believe that it is unwise to leave unanswered or uncontroverted such statements or claims as those made by Mr. Thelen and by Mr. Coleman in his "first principle." The public and many of its representatives are very prone to take advantage of any slip of the tongue or of the pen from any public utility and to use such as though it were the sentiment of all public utilities. In the past the public utility has lost more and suffered more by its policy of silence under misstatements and misinterpretation than in any other way and the "education" of the public should be such, and along such lines, as are correct and proper and equitable to all concerned, and without fear or favor. The utility has many rights which the public is bound to respect.

Very truly yours,

(Signed) H. S. COOPER.
Secretary The Southwestern Electrical & Gas. Asso.

Asks That Water Power Bill Be Supported.

Seattle, Wash., Mar. 17, 1914.

Sir:

We want, through your columns, to emphatically approve and endorse Senate Bill 4415, introduced by Senator Wesley L. Jones of Washington, for regulation of water powers in the public domain of the United States.

Our Association consists of over one thousand farmers in the central part of the State of Washington, who are owners of about 100,000 acres of some of the best arid lands in the West. Given water, it will produce any crop that can be grown in the temperate zone. It will comfortably support ten thousand people. At present, it is utterly valueless because of lack of water. An ample supply of water at all times of the year flows past its shores, 300 ft. below the land, but the water can only be secured for irrigation purposes through being raised by a pumping plant. The stream that would give the water would also furnish ample power for operating the pumping plant.

Our Association has for years been endeavoring to raise the money to develop the power, and thus through installation of a pumping plant secure the water necessary to irrigate our lands. We have found it utterly impossible to raise a dollar for this purpose owing to the arbitrary and unjust federal laws, under which capital will not invest. As the subject is of vital importance to us, we have carefully studied not only present laws, but every measure that has been introduced into Congress for a number of years, bearing upon the subject.

The federal officials have been absolutely unable to cope with this situation, probably because they have acted solely upon the advice of theoretical conservationists. The Jones Bill comes like a ray of sunlight, and we cannot see how it could be improved except that we do not think it fair for the Government to exact even the five per cent upon the value of its lands, that the bill imposes. The rights of the people are certainly well cared for in that permits are only to be granted to public service corporations, who would thus come under regulation by the public service commission in the state in which the water power is located.

No private interests should be granted these permits, but there is no reason whatever why those interested in any power development, no matter how small, should not incorporate as a public service corporation, and thus place themselves under the supervision of the Public Service Commission as to rates and service.

Our only regret is that our individual situation would not be covered by the Jones Bill, as we are located on a navigable stream, but if the Jones Bill passes, we are sure that it will mean the enactment of similar legislation covering navigable streams, which would cover our case. Congress always has the right to amend or repeal any legislation which it enacts, and we trust that the Jones Bill will be passed exactly as introduced, and without being rendered impossible of utilization through impracticable amendments.

We would like, during our own day and generation, to see our land brought under cultivation, and we think it would be much more to the benefit of future generations for us to hand

down to them our hundred thousand acres of land brought under a splendid cultivation rather than in its present arid condition.

As Senator Jones stated in the admirable speech which he made upon the water power question in the United States Senate, March 5th, out of the total available horsepower in the United States, estimated at 200,000,000 h.p., only about 6,000,000, or three per cent, has been developed. In the interest of all the people, the Government should surely offer every fair and generous inducement to capital to develop its water powers. The farmer is probably more vitally interested in the development of water powers than any other class of our citizens, because only through its development can millions of acres of arid lands in the West and Northwest be reached with water through pumping plants, and only through the use of cheap water power can the greatest known fertilizer, nitrate of lime, be produced. We think that the entire West should get back of the Jones Bill, and do all it possibly can to see it enacted into law.

Having the utmost confidence in the fairness of your views in such matters, from observations of your previous expressions anent similar subjects, we are looking forward to favorable comments through your columns in an early issue, and remain,

Very respectfully,

(Signed) MILTON E. DAM,

President The Priest Rapids Land Owners Association.

Electric Railways of the United States are dealt with statistically in a report just issued by the Bureau of the Census. The report comprises preliminary figures of the forthcoming quinquennial report of the Department of Commerce and were prepared under the supervision of W. M. Steuart, chief statistician for manufactures. The statistics relate to the years ending December 31 for 1912 and 1907, and June 30 for 1902, the last two dates being used for comparison. The totals include electric light plants operated in connection with electric railways and not separable therefrom, but do not include reports of mixed steam and electric railroads nor railways under construction during the census year which had not begun operations. The figures as presented for continental United States show general gains for the decade 1902-1912. The number of operating companies increased from 817 in 1902 to 975 in 1912, or 19 per cent. There were 41,065 miles of track in 1912 as compared with 22,577 in 1902, or an increase of 82 per cent. The persons employed numbered 282,461 in 1912 as compared with 140,769 in 1902, or an increase of 101 per cent. The revenue passengers carried in 1912 numbered 9,545,554,667 as compared with 4,774,211,904 in 1902, or an increase of 100 per cent. The gross income in 1912 amounted to $585,930,517 as compared with $250,504,627 in 1902, or an increase of 134 per cent. The operating expenses amounted to $332,896,356 in 1912 as compared with $142,312,597 in 1902, or an increase of 134 per cent. The plants aggregated 3,665,051 h.p. in 1912 as compared with 1,349,211 h,p. in 1902, or an increase of 172 per cent. The 49,153 h.p. in water wheels in 1902 increased to 471,307 h.p. in 1912, or 859 per cent. The output of stations amounted to 6,052,699,008 kw.-hr. in 1912 as compared with 2,261,484,397 kw.-h.p. in 1902, or an increase of 168 per cent. The current purchased in 1912 amounted to 2,967,318,781 kw.-hr., the figures for 1902 not being available.

WASHINGTON ELECTRIC RAILWAYS.

Preliminary figures of the forthcoming quinquennial report on the electric railways of the state of Washington have been given out by the Bureau of the Census, Department of Commerce. They were prepared under the supervision of the chief statistician for manufactures.

The statistics relate to the years ending December 31 for 1912 and 1907, and June 30 for 1902. The totals include electric light plants operated in connection with electric railways and not separable therefrom, but do not include reports of mixed steam and electric railroads nor railways under construction during the census year which had not begun operations.

The figures as presented for the state of Washington show substantial gains for the decade 1902-1912. The number of operating companies increased from 8 in 1902 to 19 in 1912, or 137 per cent. There were 1036 miles of track in 1912 as compared with 229 in 1902, or an increase of 352 per cent. There were 4761 persons employed in 1912, as compared with 1339 in 1902, or an increase of 256 per cent. The number of revenue passengers carried was 126,686,767 in 1912 as compared with 41,544,228 in 1902, or an increase of 205 per cent.

The figures are given in detail in the accompanying table:

Washington.

	1912.	1907.	1902.	Per cent of increase:[1] 1902-1912.
Number of companies	20	15	8	150.0
Operating	19	14	8	137.5
Lessor	1	1	.....	.....
Miles of line	739.07	563.48	181.89	306.3
Miles of single track	1,035.92	764.73	228.93	352.5
Miles of single track in state[2]	991.17	730.27	228.93	333.0
Cars, number	1,904	1,762	431	341.8
Passenger	976	791	312	212.8
All other	928	971	119	679.8
Electric locomotives	28	19	.....	.....
Persons employed	4,761	4,126	1,339	255.6
Salaried employes	624	362	89	601.1
Wage earners, (average number)	[3]4,137	3,764	1,250	231.0
Power:				
Horsepower, total	245,817	39,602	14,457	1,600.3
Steam and gas engines (including turbines):				
Number	28	41	34	—17.6
Horsepower	53,767	34,702	13,132	309.4
Water wheels:				
Number	43	3	5	760.0
Horsepower	192,050	4,900	1,325	14,394.3
Kw. capacity of dynamos	152,630	28,679	9,626	1,485.6
Output of stations, kw.-hr.	439,408,062	25,516,954	20,649,562	2,027.9
Current purchased, kw.-hr.	69,385,927	[4]	[4]	.....
Passengers carried	163,717,821	142,496,001	42,533,743	284.9
Revenue	126,686,767	110,506,620	41,544,228	204.9
Transfer	30,226,149	29,951,966	989,515	.....
Free	6,804,905	2,037,415	[4]	.....
Car mileage (passenger, express, freight etc.)	29,516,695	24,364,214	8,378,420	252.3
Condensed income account of operating companies:				
Gross income[5]	$13,590,933	$8,402,560	$2,542,906	434.5
Operating expense	$7,116,198	$5,140,501	$1,576,018	351.5
Gross income less operating expenses	$6,474,735	$3,262,059	$966,888	569.6
Deductions from income (taxes and fixed charges)	$4,033,973	$1,788,314	$463,101	771.1
Net income	$2,440,762	$1,473,745	$503,787	384.5

[1] A minus sign (—) denotes decrease.

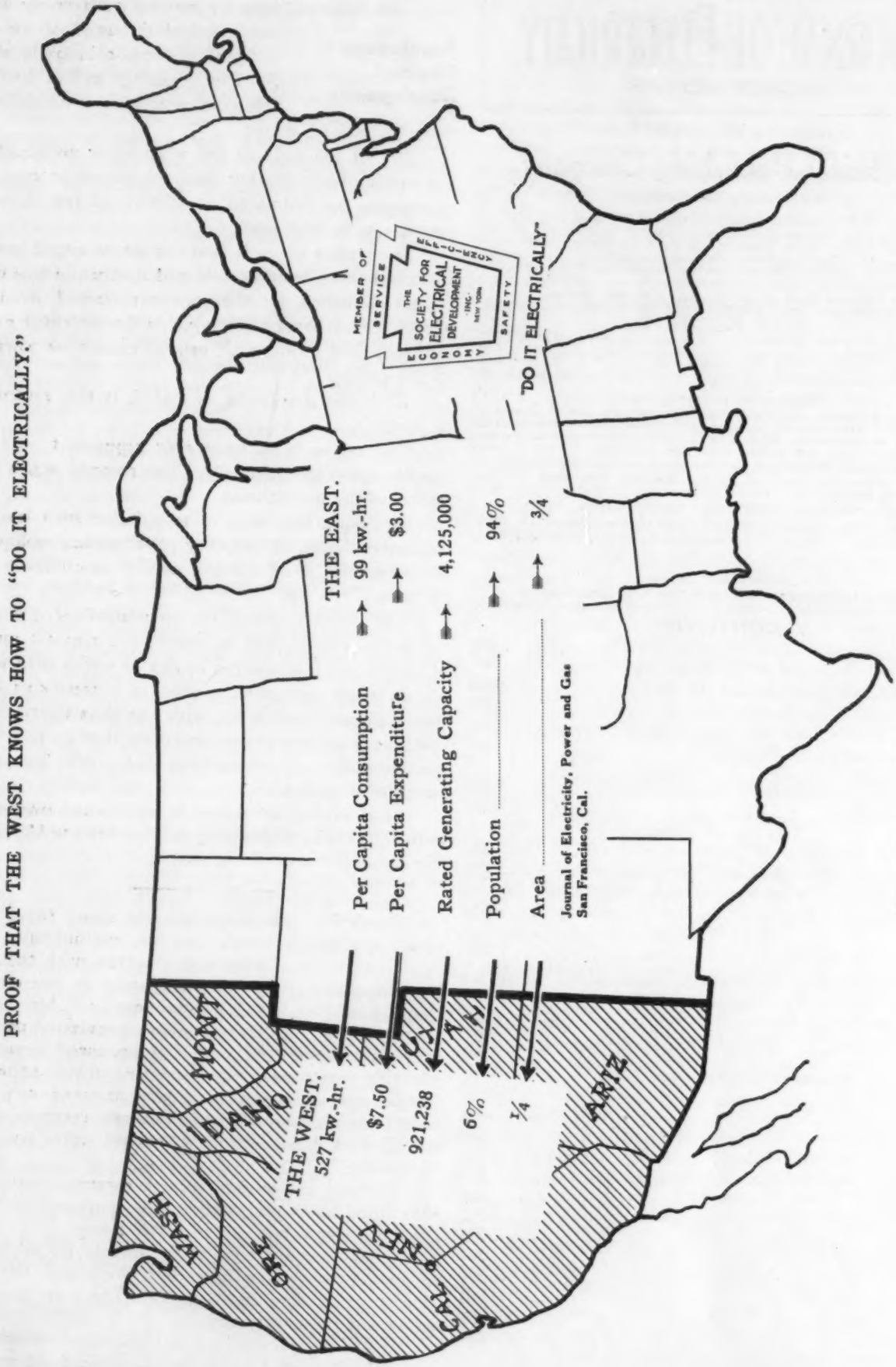
[2] Excluding track lying outside of state of companies within state.

[3] Number employed Sept. 16, 1912.

[4] Figures not available.

[5] Income from sale of current for light and power included: In 1912, $4,422,080; in 1907, $1,182,423; and in 1902, $641,800.

Note:—The large increase in power and output of stations from 1907 to 1912 was due in part to the consolidation of light and power and railway companies.



Compiled from the 1912 U. S. Census Report on Electric Lighting.

JOURNAL OF ELECTRICITY
POWER AND GAS

PUBLISHED WEEKLY BY THE

Technical Publishing Company

Rialto Building, San Francisco

E. B. STRONG, President and General Manager
A. H. HALLORAN, V. P. and Managing Editor
ROBT. SIBLEY, Treas. and Special Contributor
C. L. CORY, Secretary and Special Contributor
A. M. HUNT, Director and Special Contributor

On Library Cars of all Southern Pacific Trains.

TERMS OF SUBSCRIPTION.

United States, Cuba and Mexico	per year,	$2.50
Dominion of Canada	" "	3.50
Other Foreign Countries within the Postal Union	" "	5.00
Single Copies, Current Month	each	.25

NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advanace of date of issue.

Entered as second-class matter at the San Francisco Post Office as "The Electrical Journal," July, 1895.

Entry changed to "The Journal of Electricity," September, 1895.

Entry changed to "The Journal of Electricity, Power and Gas," August 15, 1900.

Entry changed May 1, 1906, to "The Journal of Electricity, Power and Gas," Weekly.

FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

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Regulations Obstruct Development

In this issue is published a letter which states that over one thousand farmers owning collectively about one hundred thousand of the best acres of the semi-arid lands of the State of Washington, find that land rendered practically valueless because of lack of water.

Yet all the days of the year water sufficient for the needs of this thirsty land—sufficient to enable it to support an estimated population of ten thousand people—flows idly past.

The reason given is that the water would have to be raised three hundred feet and that while this could be accomplished by the power extracted from the water, federal laws affecting this development are so arbitrary and unjust that capital cannot be attracted to the project.

With the conditions as stated, is this reasonable or just?

Oppressive laws were ever repugnant to a free people—a sovereign people. The remedy is the abrogation of the unjust laws.

The point may also be raised that such laws are unconstitutional, in that they prevent the development of the resources of a State, even in accordance with its laws.

The country should be so administered that its resources will be used to benefit the greatest number of people and not allowed to run to worse than waste.

Is is not more sane to leave to posterity an inheritance of cultivated acres, with comforts electrical and other necessities and conveniences, than to pass on to them unimpaired, an undeveloped power site and a waste of arid lands?

As a nation, let us cry a halt to the power that impoverishes by preventing development and by ignoring the necessities of the now.

Development Control

Pondering the foregoing and many other arguments brought to mind, there are undoubtedly many who will disagree with the statement made early in the concluding instalment of Mr. L. B. Harza's able presentation and comprehensive review of new and proposed regulations affecting water power development, which appears in this issue, to the effect that "the department of agriculture, through ownership of the forest reserves, is able to and does dictate terms to control water power development."

The act establishing forest reserves, stated that they could be created, among other purposes, for securing favorable conditions of water flows.

Under certain conditions, forests do advantageously control water flow, but there are conditions conducive to the opposite effect. There are also other important regulatory factors.

It is fully established that the dams necessary to hydroelectric development to store the flood waters—which may be flood waters despite the forest reserves—are beneficial in their effect upon stream flow.

Due to these dams water otherwise running to waste may be used for irrigation or for domestic purposes.

This was undoubtedly recognized at the time of passing the act, for it provides that all water on forest reserves may be used, in accordance with the law, for domestic, irrigation and other purposes.

From the provisions made it would seem that it is the duty of the secretary of the department having jurisdiction to do everything possible to facilitate the development of water power possibilities located within forest reserves, as furthering the objects for which the reserves were created.

The act also stated definitely the nature of the rules which the administrating department could make. Although there are later acts and provisions than the original, it is said that none pretend to alter the purposes for which the reserves could be created or the substance of the rules the administrating department is authorized to make.

The need for the most beneficial use of water is so apparent as to require no justification or defense, and this act, recognizing this principle, directs that the water shall be so used.

But the control of the development of water power is, almost entirely throughout the West, vested in the State. The act in such cases may therefore be construed, that the secretary of the department having jurisdiction shall formulate rules which shall facilitate the state's administration of these resources. The state having authorized certain water power developments, the law then provides for the easy co-operation of the federal government in the granting of the rights of way across forest reserves and for other concessions needed for the proper realization of the ends sought.

Within such reserves the laws with respect to the appropriation and use of water are, as they should be, in full force and effect. Consistent with local rights and necessities, the act implies that the reserves shall not be closed to such use.

Furthermore, there is the possible construction that the fees charged and collected by the Government for the beneficial use of water within forest reserves is in the nature of an excise tax—a tax upon industry and prohibited under the Constitution unless levied uniformly, throughout the United States.

Mr. Harza's statement may, and undoubtedly does, describe an actual artificial condition, but from the foregoing recital it would appear that it may not have the support of law.

While the United States Government has a proprietary right in the reserves, it has no municipal right, neither may a bureau make regulations nor collect tolls except in accordance with existing provisions of constitutional acts of Congress.

A Water Power Competitor

One is apt to refer to the people as a body apart from private corporations which are naturally composed of a part of the people. It is in this sense, that ownership of water power possibilities is said to belong to the people.

They do, but unless utilized by the people or their use delegated to others, this Tantalus of nature's wealth will some day surely mock them.

Through their representatives, and either with or without their consent, the people are endeavoring to extort from private corporations the utmost penny for the use of their property, blind to the fact that their ownership does not constitute at this time a monopoly, as they are to the further fact, that this form of taxation does not increase wealth.

Where collected in connection with the operation of a public utility, it increases operating costs, and the taxes collected and returned to the people, add to the cost of the product the interest on those taxes which, incidentally, are also reduced by the amount necessary to their collection and disposition before being returned.

A tax upon a utility is an added burden upon the consumer.

The private corporation operating public utilities has been forced into the position of a buyer of power. This is bought in a competitive market. Your private corporation may use water power, steam power, or gas.

With steam power at the present time there is no undue governmental "control" resulting in a heavy burden of taxation or of legal expenses. It is therefore reasonable to suppose that invention and progress will be directed along the line of the use of steam power. An efficiency of production may in this way become so possible that the present undeveloped water power of the people will remain a waste, as in former years.

If private corporations held such magnificent resources within their control, but failed absolutely to make them profit-producing, the public, with the shoe then on the other foot, would deride, condemn and probably strive to confiscate.

A premium upon water power development may yet prove the eager reward of the people to the private corporation.

An interesting condition is pointed out by Mr. Crawford in this issue where central station companies have found it most profitable to purchase power from large lumber mills. Excessive taxation and legal and engineering water power development expenses have in this way been avoided.

In California and Oregon, notwithstanding their enormous water power awaiting development, the central station electric light and power plants have a practically equal generating capacity of water and steam power. In both these states power generating conditions are competitive. The property of the people is running to waste.

In the larger cities, skyscrapers and extensive buildings with their private installations may also prove ultimate water power competitors by co-operating with central stations in the operation of their steam power plants.

These arguments suggest still further the necessity for handling the water power situation to suit local conditions and the absurdity of endeavoring to frame a nation-wide panacea ignoring these, by endeavoring, for example, to charge a uniform rental where conditions are not uniformly comparable.

A continuance in the present course may some day find the people without a market for their product and unable even, for economic reasons, to sell it to themselves.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

F. H. Leggett, Pacific Coast manager Western Electric Company, is at Los Angeles.

Harry Adams of the Phillips Insulated Wire Company, Pawtucket, R. I., was in Seattle during the past week.

H. G. Lacey, proprietor of the Hanford Water & Power Company, Hanford, Cal., was a San Francisco visitor last week.

H. Frickey, engineer Northern California Power Company, was at San Francisco from Redding, Cal., during last week.

Harry Kirkland, vice-president and manager of the American Conduit Manufacturing Company, spent two days in Seattle, this week.

L. E. Torrey, electrical engineer, has left for Riverside, Cal., on business, and expects to be away from San Francisco for about one month.

M. W. Hull, manager of the California office of The Hess Flume Company, was at San Francisco from Los Angeles during the past week.

Geo. A. Boomer, Pacific Coast representative Plume & Atwood Manufacturing Company, with offices at San Francisco, is at Seattle on business.

J. B. Lukes, representative Stone & Webster Construction Company, is visiting the Truckee River General Electric Company's plant at Reno, Nev.

A. H. Noyes, salesman Electric Appliance Company, will return to Oregon from California where the past few weeks have been spent on company business.

J. H. Larmouth has been appointed manager of the Edmonton Municipal Electric Railway System, Edmonton, Alta., vice **W. T. Woodroofe,** superintendent, resigned.

F. E. Newbery of Newbery, Bendheim Electric Company, who has been spending the past month at Los Angeles, is expected to arrive in San Francisco this week.

D. G. Smith, of Smith & Hemenway, manufacturers of "Red Devil" tools, is returning to New York from the Pacific Coast by way of Los Angeles and Salt Lake City.

Paul A. Shilton, Los Angeles representative of R. J. Davis, district sales agent of Century Electric Company, St. Louis, has left on an extended tour of Arizona and New Mexico.

J. Harry Pieper, assistant general agent, Southern California Edison Company, Los Angeles, Cal., received the sad news last week of the sudden death at Boston, of his mother.

E. R. Murray, salesman for the Western Electric Company in the San Joaquin Valley, has just returned from a combined vacation and business trip to the Hawaiian Islands.

C. B. Hawley, manager of the Intermountain Electric Company, has returned from Pocatello, where he has spent a week in connection with company business in that territory.

M. G. Adler, chief draughtsman bureau of Los Angeles aqueduct power at Los Angeles, Cal., has been transferred to the grade of member in the American Institute of Electrical Engineers.

W. H. Trask, formerly commercial agent of the Idaho Railway, Light & Power Company, has taken a position in the commercial department of the Utah Power & Light Company at Salt Lake City.

Geo. R. Thomson, representing R. J. Davis, district sales agent of Century Electric Company, has just returned to San Francisco, having visited all the cities and towns in the San Joaquin Valley.

W. S. Heger, formerly Pacific Coast manager for the Allis-Chalmers Company, has been appointed manager Pacific Coast sales division Busch-Sulzer Bros. Diesel Engine Company, with offices in the Rialto Bldg., San Francisco.

Lewis Degen, of Long Beach, California, has been invited to address the newly appointed Fire Alarm Commission of Los Angeles, by that body so that they may have the benefit of his experience and ideas as a fire alarm expert.

B. H. Scranton, president, and **Frank Kuhn,** vice-president of the American Electrical Heater Company, were in Seattle during the last week, but spent Thursday in Tacoma in company with **H. D. Brainard,** Seattle sales manager of the Western Electric Company.

J. T. Stewart, who has, since the discontinuance of the San Francisco warehouse of the Holophane Works of General Electric Company, been employed in the city sales office of Dunham, Carrigan & Hayden, has again joined the forces of the former company as city salesman.

F. A. Osborn, University of Washington, Seattle, Wash., has been appointed a member of the National Membership Committee of the Illuminating Engineering Society. Other Pacific Coast members of the committee are **F. H. Murphy,** Portland, Oregon; **R. H. Manahan,** Los Angeles, Cal., and **H. E. Grant,** San Francisco.

Belvidere Brooks, formerly in charge of the Denver office, will succeed **Theodore N. Vail,** as president of the Western Union Telegraph Company, according to apparently authentic information received, which states that the new appointment will become effective as soon as the Western Union has been divorced from the American Telephone & Telegraph Company.

F. D. Schwartz, general sales manager Indiana Rubber & Insulated Wire Company, Jonesboro, Ind., is at San Francisco on a business trip being made in the interests of his company through the western territory. Mr. Schwartz was previously city sales manager in the Chicago office of the Electric Appliance Company. He will return East by way of Los Angeles and Salt Lake City.

N. W. Reed, inspecting engineer, Board of Fire Underwriters of the Pacific, at San Francisco, for the past seven years, has resigned from that position on account of sickness and general nervous breakdown. During his service he has been instrumental in improving standards of electrical construction and in creating a stronger feeling of co-operation and harmony with the electrical contractors throughout California. It is with regret that his many friends have learned of his resignation and while his plans for the future are undecided it is hoped that he will finally again locate in this district.

R. J. McClelland, chief engineer of the Electric Bond & Share Company of New York City, accompanied by **Louis Elliott,** New York engineer of the same company for the Utah, Idaho and Colorado district, **H. H. Dewey,** engineer for the General Electric Company in the power and mining department, handling matters in the same territory, and **F. C. Green,** engineer of the transformer department at the Pittsfield Works of General Electric Company, have been at Salt Lake City during the past week going over the system of the Utah Power & Light Company, particularly with reference to the 110,000 volt transmission system which that company proposes to place in operation in the near future.

Bertram Smith has just arrived in San Francisco, having been appointed assistant manager of the Edison Storage Battery Supply Company with headquarters in that city. Mr. Smith was originally with the American Bicycle Company as manager of the Buffalo plant and later with the National Battery Company as secretary and treasurer for a period of three years, after which he joined the sales force and remained with the National Battery Company up to 1908 when it was absorbed by the United States Light & Heat Company of Niagara Falls. He was with the United States Light & Heat Company for six years working principally out of the Chicago office, and during that time actively engaged in railway car lighting work, automobile lighting and electric self starters. Mr. Smith is very well known all over the United States in his field.

MEETING NOTICES.

Portland Sections, A. I. E. E. and N. E. L. A.

The next joint meeting will be held at 8:00 p. m. April 7th in the Hawthorne Building. The paper of the evening will be given by F. D. Weber, electrical inspector of the Underwriters' Equitable Rating Bureau on the subject, "Is Underwriters' Inspection Necessary in Oregon?"

Seattle Bell Telephone Society.

The Bell Telephone Society of Seattle held its monthly meeting at Eilers Hall, Tuesday, March 17th. The technical paper of the evening was read by District Commercial Engineer S. M. Treen on "Commercial Practice." The entertainment committee presented an interesting program.

Seattle Jovian League.

The Seattle Jovians held their weekly luncheon at the Lincoln Hotel Friday, March 20th, when a committee appointed to look into the advisability of establishing a permanent exhibit of electrical apparatus for use of architects and builders reported progress. There was a good attendance.

Los Angeles Section A. I. E. E.

The regular meeting of the Los Angeles Section of the American Institute of Electrical Engineers, on March 25th, was devoted to a lecture by Max Loewenthal, upon "Electricity as a Source of Heat." As it was ladies' night, the speaker introduced a number of interesting experiments, slides and moving pictures, which showed the advantages of electricity in the home.

Safety First Meeting at Seattle.

The members of the Safety Committee of the Puget Sound Traction, Light & Power Company were guests of the company at dinner at the Washington Annex Hotel Wednesday, March 18th. There were one hundred and fifty members present and addresses were presented by H. D. Henderson, Hugh A. Tait, A. J. Falknor, J. F. Cooper, H. S. Elliott, Dr. Park Weed Willis and A. L. Kempster.

San Francisco Electrical Development and Jovian League.

"An Outline of the Life and Work of George Westinghouse," was ably presented by Thos. E. Collins at the regular weekly meeting held at the Hof Brau last Tuesday. At the conclusion resolutions were adopted recording the sorrow of the league at the death of the great inventor and manufacturer. The resolutions were ordered spread upon the minutes and the address presented by Mr. Collins made a permanent record in the archives of the league.

Oregon Society Engineers.

The next regular meeting of the Oregon Society of Engineers will be held in room "A" of the Public Library, Portland, Oregon, at 8:00 p. m. April 15th.

The speakers of the evening will be John H. Lewis, state engineer, who will speak on the accomplishments of his office during his incumbency as state engineer. Fred F. Henshaw, district engineer, Water Resources Branch, United States Geological Survey, on "Stream Gauging in Oregon." E. G. Hopson, supervising engineer, U. S. Reclamation Service, "Government Co-operation in the Celilo Project." These talks will be all illustrated with lantern slides.

Utah Electric Club.

At the regular weekly luncheon held at the Salt Lake Commercial Club Thursday, March 19th, George J. Henry, consulting hydraulic engineer at San Francisco, who is at Salt Lake City on special business, gave some very interesting reminiscences connected with the installation of the first water power plants in Utah, and told something of the recent developments and performance of high head plants now in operation.

W. F. Jensen, president of the Salt Lake City Commercial Club, the regular speaker of the day, took for his subject, "The Building of a Metropolis." He pointed out the futility of attempting to build a great city without first developing the territory tributary to it, and indicated the prominent part which electricity is playing in the development of the territory contiguous to Salt Lake City, and how its use may be still further extended particularly in its application to the farming, poultry and dairying industry.

The Jovian Electrical League of Southern California.

In view of the intense interest which everyone in the Southland, especially the electrical fraternity, is taking in the power controversy between the city of Los Angeles and the three power companies, a record attendance occurred last Wednesday at the meeting held at Los Angeles, to hear the companies' side of the case as presented by R. H. Ballard, general manager of the Southern California Edison Company. Mr. Ballard reviewed the entire situation with a view of showing the disloyalty and lack of foresight on the part of the city council and the defensive attitude which the companies will have to assume for the protection of their own bondholders as well as the public. He pointed out the folly of permitting the city during the five year lease period to alter the distributing systems of the companies and the illegality and therefore impossibility of the companies to binding themselves at this time to sell the system at the end of the five year period. Now the council proposes the shortsighted and dangerous policy of condemning the systems, after the companies' thirty years' struggle to build up a legitimate business. It is hard to predict what such a policy would mean to investors proposing to put money into California public utilities. The companies, resisting such an arbitrary course, would take the matter into the state courts, and should they lose, the bondholders would then take the matter into the U. S. Supreme Court which would precipitate a long drawn out legal struggle. The combined power house and distributing system bond issue is, furthermore, contrary to the provisions of the city charter, according to Mr. Ballard. He predicted the defeat of the bond issue on May 5th, which will be conducted at an expense to the taxpayers of $40,000. The speaker, after the able presentation of his argument, was loudly cheered and a vote of thanks was tendered through E. R. Northmore, the chairman of the day.

The announcement by Max Loewenthal that the Society for Electrical Development had been successful in obtaining the subscription fund of $200,000 and was now ready to begin operations, was greeted with applause, and his resolution endorsing the establishment of a Pacific Coast office of the Society was adopted unanimously.

N. E. L. A. COMMERCIAL SECTION MEMBERSHIP CAMPAIGN.

An active membership campaign is being conducted by the Commercial Section of the National Electric Light Association, under the aggressive leadership of Mr. J. F. Becker, commercial agent of the New York Edison Company, who has appointed "captains" of each state. These are now circularizing those eligible for membership, and the results are already gratifying.

Central station men (Class B members), jobbers and manufacturers' representatives and electrical contractors (Class D members), may all become members of the commercial section and enjoy the many advantages which it offers.

The dues are merely nominal, and are more than offset by the value of the practical publications mailed to members of this section.

The commercial section enjoys a prominent place in the activities of the N. E. L. A. and is said to be the most active off-spring of the parent association. Its work, especially in standardizing methods is of great value to all.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS.

California Section.

C. W. Mitchell, president. W. G. Pennycook, vice-pres.
John W. Carrell, sec-treas., 55 Fulton street, San Francisco.

The purpose of this organization is to standardize the common practice in electrical construction with the National Code as the general standard.

Questions pertaining to electrical construction will be answered in these columns but only from the point of view of the Code. This is a voluntary organization and the answers published under this heading must not be construed as authoritative, or binding. No attempt will be made to correllate the answer from the several Inspection Districts as an occasional difference of opinion will tend to induce further study on subjects. All questions will be passed upon by an executive committee.

Address all communications to the secretary.

The California Section of the N. A. E. I. held its second meeting at the office of the Board of Fire Underwriters of the Pacific, 914 Merchants' Exchange Building, San Francisco, Saturday, March 14th. The next meeting of the section will be held at the same place on March 28th.

By the Secretary.

The battle is on. We can read a lively sermon in the mighty array of interrogation points. At first we were apprehensive lest the electrical public should not take kindly to our question-box, but our fears have melted away. Questions came in before they were invited. We know our work, our destination, and we are on the way.

To take rise from its origin and exist is one incident in the natural order of things. To develop and succeed is the result of healthy sustenance and mental effort. The chief sustaining force of this organization is public interest in the concrete form of questions on electrical construction met with in practice. If you wish us success send in your questions.

IDAHO PUBLIC UTILITIES COMMISSION.

Arising out of the complaint of the village of Wesdell against the Great Shoshone & Twin Falls Company to the effect that its rates were excessive and discriminating, the commission ordered that the company, and the Idaho Power & Light Company and the Beaver River Power Company also made party to the proceedings, collect all outstanding bills so that all consumers should be fully paid up and further ordered the schedule of rates to be charged in the village and in the towns of Mountain Home, Glens Ferry and Gooding.

As a result of complaints being made by numerous customers of the Southern Idaho Water Power Company the commission ordered the rates which should be charged by the company at American Falls, Pocatello, Fort Hall and Blackfoot. These range from 9 cents to 4 cents per kw.-hr., with a monthly minimum of one dollar per month.

The Homedale Water, Power & Light Company was granted a certificate of public convenience and necessity for the construction of a water system within the village of Homedale.

In the matter of establishing uniform rates to be charged by central station companies as instigated by the commission it was ordered that they be established. Schedule A covers commercial and residence lighting and ranges from 9 cents to 3 cents per kw-hr., Schedule B, a domestic cooking rate of 2½ cents per kw.-hr., and Schedule C a commercial cooking rate based upon the monthly guarantee per connected kw., and ranging from a guarantee of $1.50 with a rate of 2 cents per kw.-hr., to $3.50 guarantee, which permits a one cent rate. All are subject to a discount of ten per cent for prompt payment and Schedules A and B to a monthly minimum charge, irrespective of connected load of $1 per month.

NEWS OF THE CALIFORNIA RAILROAD COMMISSION.

The Oceanside Electric & Gas Company has been granted authority by the commission to renew notes in the sum of $12,442, and to issue its six per cent twenty year bonds in the sum of $25,000, a sufficient number of which will be sold by the company at ninety per cent of the par value so as to net the applicant $14,100, which sum will be applied to the payments of the notes and to reimburse the treasury for additions and betterment.

The commission has rendered a decision granting authority to the Pacific Freight Traffic Bureau, which includes the Southern Pacific Company and the Atchison, Topeka & Santa Fe Railway coast lines, to change the classification of oil barrels or drums and glycerine barrels. A slight increase in less than carload shipments results, with a decrease in carload charges.

The Atchison, Topeka & Santa Fe Railway Company, the Southern Pacific Company, the San Pedro, Los Angeles & Salt Lake Railroad Company, the Western Pacific Railway Company, have filed application with the commission asking authority to amend fares, rules and regulations with respect to drawing rooms and compartments in standard Pullman sleepers.

The commission has issued an order instituting on its own initiative, an investigation into the rates charged for natural gas delivered at the limits of the city of Long Beach, Los Angeles county.

The commission has instituted an investigation on its own initiative into the rates, services and extensions of the Pacific Gas & Electric Company in its San Jose district.

The commission rendered a decision upon the application of the Southwestern Home Telephone Company of Redlands for authority to issue $101,300 in short term notes and to pledge $197,000 in bonds as collateral security therefor. The commission does not make a final ruling in the case but states that it will hold the matter in abeyance until July 1, 1914. It directs the company to take steps to reduce its indebtedness, both floating and bonded indebtedness. The commission also calls upon the company to arrange to cancel $300,000 in stock which was issued originally on a contract by which the company had the right to retire it upon the payment of $3,750.

William G. Henshaw, as proprietor of the Crescent City Railway Company, has made application to the commission for a certificate of public convenience and necessity authorizing the Crescent City Railway Company to construct a system of street car lines in the city of Rialto, San Bernardino county.

The San Diego Consolidated Gas & Electric Company has filed an application with the commission asking the authority of the commission to float a bond issue of $18,000 to reimburse the company for expenditures, additions and betterments.

The commission has granted a decision authorizing the transfer of the Deer Creek Rural Telephone Company, Tulare county, to the Pacific Telephone & Telegraph Company.

The Oakdale Gas Company has filed an application with the commission for a certificate of public convenience and necessity, authorizing it to exercise rights granted under a franchise to do business in Stanislaus county.

The commission has rendered a decision authorizing the sale of $15,000 preferred stock of the Pitt River Power Company to be sold at not less than 80 per cent of the par value. The funds are to be applied to the development of the applicant's hydroelectric system at Burney Falls.

The commission has rendered a decision modifying in some respects its readjustment of the long distance telephone rates of the Pacific Telephone & Telegraph Company in the state of California and directing that the new and reduced rates should go into effect on or before March 21 of this year. The commission's order, instituting an entire

new schedule of long distance rates, will mean a reduction of approximately $506,000 in the sum now paid annually by the people of California for long distance service. In its present order the commission makes two changes from its original decision in this matter. The first change affects the rates within the 44 mile zone. The second change affects the two party service.

The commission has issued an order granting the San Joaquin Light & Power Company authority to refund existing notes in the sum of $200,000.

The commission has issued an order in which it finds that the Western States Gas & Electric Company has been discriminating among its patrons in the vicinity of Lodi, San Joaquin County, and has been affording to some of its patrons rates which are lower than the rates on file with the commission. In its order the commission directs that the Western States Gas & Electric Company shall cease its discrimination and shall put into effect a new rate for agricultural service. The commission states further that if this new rate is not as low as the lowest rate now being given to those patrons in whose favor it has been discriminating the commission will institute an investigation into all of the rates, regulations and practices of the company and that this investigation will also include a consideration of the "conduct of the company in departing from the legally established rates and schedule on file with this commission."

The Napa Valley Electric Company has applied to the commission for a certificate of public convenience and necessity asking for authority to operate in the territory now occupied by the Calistoga Electric Company which is serving the town of Calistoga and vicinity.

S. Waldo Coleman has filed an application with the commission asking that the commission grant a certificate of public convenience and necessity, authorizing him to maintain and operate a gas plant and distributing system in the towns of Concord, Martinez, Antioch, and the city of Pittsburg, Contra Costa county.

The commission has cited the California Natural Gas Company of Bakersfield and the West Side Gas Company of Taft, to show cause, April 4, before the commission at San Francisco, why an investigation should not be made into the rates charged for natural gas by the companies.

The Pacific Gas & Electric Company has filed an application with the commission asking authority to issue five per cent one year collateral gold notes in the aggregate sum of $7,000,000, to be sold at not less than 96.5. Five million dollars of the sum asked will be employed in discharging and refunding the company's six per cent gold notes now outstanding. The balance of the issue will be employed in reimbursing its treasury and for additions and betterments.

The Ventura County Power Company has made application to the commission asking authority to issue $200,000 five year six per cent notes. The funds to be derived from the sale of the notes will be employed in refunding outstanding obligations aggregating $120,850. for the construction and completion of a power line and a hydroelectric generating plant to be used by the Ventura Water System.

The Western States Gas & Electric Company has filed an application with the commission asking that the contract between the applicant and the Sierra & San Francisco Power Company, dated December 4, 1911, by which the Sierra & San Francisco Power Company delivered electric energy to the Western States Gas & Electric Company at Manteca at a price of 8¾ mills per kw.-hr., be amended. The Western States Gas & Electric Company objects to the contract upon the grounds that the price is excessive, that the conditions in the contract relating to the load factor are confiscatory, that the Sierra & San Francisco Power Company is discriminating in favor of other companies, and that the life of the contract is unreasonably long.

Frank Kummeth has filed an application with the commission asking authority to sell the Sanger Water Works to the city of Sanger, in Fresno county. The city of Sanger has voted a bonded indebtedness of $32,400 to acquire a municipal water plant and Mr. Kummeth is now negotiating the sale of his properties to the municipality.

The Northwestern Pacific Railroad Company has filed an application with the commission asking authority to issue bonds in the sum of $5,543,000. The issue will be sold to the Southern Pacific Company at 95 per cent and the bonds will bear 4½ per cent interest, secured by a mortgage and deed of trust to the Farmers' Loan & Trust Company, executed March 1, 1907.

INTERNATIONAL ENGINEERING CONGRESS, 1915.

Rapid progress is being made in working out the final program of papers for the International Engineering Congress to be held at San Francisco in 1915.

The first volume of the publication of the Congress will consist of a series of articles descriptive of the various technical features of the design and construction of the Panama canal. The various topics which will be treated are noted in the following list:

(1) Introductory Chapter.
(2) Dry Excavation for the Panama Canal.
(3) Dredging in the Panama Canal.
(4) Terminal Works, Dry Docks, and Wharves of the Panama Canal.
(5) Permanent Shops of the Panama Canal.
(6) Coaling Plants and Floating Cranes of the Panama Canal.
(7) Meteorology and Hydrology of the Panama Canal.
(8) Design of Locks, Dams, and Regulating Works of the Panama Canal.
(9) Method of Construction of the Locks, Dams, and Regulating Works in the Atlantic Division of the Panama Canal.
(10) Method of Construction of the Locks, Dams, and Regulating Works in the Pacific Division of the Panama Canal.
(11) Design of Lock Walls and Valves for the Panama Canal.
(12) Design of the Spillways on the Panama Canal.
(13) Gates of the Panama Canal Locks.
(14) Electrical and Mechanical Installations of the Panama Canal.
(15) Emergency Dams Above Locks of Panama Canal.
(16) Municipal Engineering and Domestic Water Supply in the Canal Zone.
(17) Reconstruction of the Panama Railroad.
(18) Aids to Navigation of the Panama Canal.
(19) Geology of the Panama Canal Zone.
(20) The Working Force of the Panama Canal.
(21) Sanitation in the Panama Canal Zone.
(22) Purchase of Supplies for the Panama Canal.

Each of these topics will be treated by someone on the canal force who has been responsible for the design and construction described. The introductory chapter as well as the topic of Dry Excavation for the Panama Canal will be handled by Colonel Goethals himself.

This volume will constitute practically an official technical record of the gigantic engineering feat which is just nearing completion and will be of interest, not only to engineers but to laymen. No similar volume has as yet been prepared upon the canal, nor is it probable that any such will be in the future. The advantage is being taken of the congress to draw together under one cover in this way, the statements of the men who have been responsible for the work.

The program of papers for the various sections of the congress is practically completed and notices of them will be published in the near future. Subscriptions to the congress are being received daily and on March 1 the number of enrollment was slightly in excess of 1200, of which over 200 are from foreign countries and about 1000 from the United States. Subscription blanks have been mailed through the various National Societies to many thousands of engineers in this country and through the foreign societies to foreign engineers. The response already received is very encouraging, but it is trusted that all engineers interested in the success of the congress will not fail to send in their subscriptions as early as possible. Delay in so doing renders the task of the committee of management more difficult, and makes it impossible to form any just estimate of the receipts which may be expected and the number of copies of the volumes which have to be published.

ANNUAL REPORT BELL TELEPHONE COMPANY.

The continued growth of the Bell System, its earnings and expenses and general financial prosperity, its attitude as to government ownership, its agreement with the Department of Justice, the sale of its Western Union holdings and its relation with the general public are all set forth in detail in the annual report of the American Telephone & Telegraph Company just issued. President Theodore N. Vail states that the common impression that the Postmaster General has made a report favoring the acquisition of the wire lines is erroneous. As to possible government purchase, Mr. Vail quotes Congressman Lewis, the Congressional exponent of government ownership, to the effect that there is no water in the Bell capitalization; and urges the stockholders not to be induced to part with their holdings through fear of confiscation. Americans are better supplied with telephone facilities than any other people, having six times as many telephones per capita as Great Britain and thirteen times as many as France, and that the rates here are as popular as those of any government-owned plant. Europe has only two-fifths of the telephone traffic of the United States..

During the past year subscribers' telephone stations have increased until now there are 8,133,017, a gain of 676,-943. These stations reach 70,000 localities or 10,000 more than the number of postoffices. The total wire mileage is 16,111,011, of which 92 per cent is copper. More than half the wire mileage is underground, the total underground plant representing a cost of $181,500,000. The number of daily telephone connections showed a growth of nearly two million, reaching an average of 27,237,000 a day.

The extension of the telephone plant during the year amounted to $54,871,856, making a total for fourteen years of $646,915,200. According to present estimates the construction for the current year will cost in the neighborhood of $56,000,000, of which the local resources of the companies will supply $25,000,000. A steady improvement of service has been achieved.

The engineering evolution of the telephone which has been accomplished by the engineers, is reviewed. At headquarters the Bell System has a force of 550 engineers and scientists, a staff unequaled in the world, wholly engaged on studies of these subjects.

The report shows that under the pensions, disability benefits and insurance plan, employes had participated in benefits which have aggregated over one million dollars.

REVISION OF BUREAU OF STANDARDS CIRCULAR NO. 32

The Bureau of Standards is preparing a revised edition of its Circular No. 32, "Standard Regulations for Manufactured Gas and Gas Service," to replace the second edition which is now out of print. It is proposed not only to bring up to date the compilation of rules and regulations now in force, but also to make such other changes as may be necessary to correct or improve the Circular. The Bureau will be glad to have suggestions from any one interested in this publication within the next two or three weeks. Comments of this sort should be addressed to the Director, Bureau of Standards, Washington, D. C.

PUBLICATIONS RECEIVED.

Latent Heat of Fusion of Ice. Scientific Paper No. 209, U. S. Bureau of Standards, Washington, D. C.

Accuracy of the Formulas for the Ratio, Regulation and Phase Angle of Transformers. Scientific paper No. 211, U. S. Bureau of Standards, Washington, D. C.

"Rules, Requirements & Universal Safety Standards" is the title of a booklet compiled by Carl M. Hansen, secretary Workmen's Compensation Service Bureau, New York. It contains most valuable data regarding accident prevention.

NEW CATALOGUES.

Yuba Irrigation Pumps (Model D) are described in Catalogue 22 issued by The Yuba Construction Company, San Francisco.

Bulletin No. A4143 issued by the General Electric Company, is devoted to Belt Driven Alternators, known as Form B, and supersedes the company's previous bulletin on this subject.

The Jefferson Glass Company, Follansbee, West Virginia, is distributing a magnificent portfolio among architects, of selected fine art designs. Their application to fixtures of proper design is also illustrated.

The General Electric Company recently issued Bulletin No. A4189, Small Plant Direct Current Three-Wire Switchboards of 125 and 250 volts, and 10 to 100 kw., which supersedes the company's previous bulletin on this subject.

Small Motors, is published monthly by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describes some of the applications of the small motors manufactured by this company. No 18 is being distributed.

The Dubilier Electric Company, Inc., 63 Fifth Avenue, New York City, are distributing a loose leaf catalogue, containing descriptive bulletins of resistance units, heating, high frequency, wireless, medical and other apparatus.

"Electric Household Helps," a folder (No. 4197) issued by the Westinghouse Electric and Manufacturing Company, illustrates the use of electric devices in the home, contains a complete price list and shows the watts consumed by each device.

Hospital Signal Systems are fully described in Circular No. 15003 now being distributed by the Holtzer Cabot Electric Company, New York. It covers very thoroughly this company's patients' call system of doctors and nurses and includes the use of an efficiency elapsed time recorder.

An eight page price list, envelope size, is being mailed by the Sprague Electric Works of General Electric Company, New York, to all interested in Portable Ozonators. It is No. 852 and gives a description of a combined ozonator and electric fan in addition to prices and general particulars.

"Westinghouse Portable Meters" (Circular 1104) is the title of a publication just issued by the Westinghouse Electric & Manufacturing Company describing its complete line of portable instruments. A number of detail and complete photographs are shown together with various diagrams.

Catalogue Section DS843 covering catenary line material just issued by the Westinghouse Electric & Manufacturing Company, describes and illustrates with considerable detail the different types of insulators, hangers, strain ears, etc., together with diagrams showing the spacing for wheel trolleys and pantagraph trolleys.

A handy Railway Hand-Book, 1914, leather covered and of vest pocket size is being distributed by the General Electric Company, Schenectady, Pa., which contains a great amount of valuable information, technical and general. It contains information on the Modern Railway Motor, Gearing, Control, Air Brakes, Electric Locomotives, Gas-Electric Motor Cars, The Curtis Steam Turbine, on many other subjects. Many valuable tables and data is included. There is also an atlas and pages for sketch notes.

"Westinghouse Starting, Lighting and Ignition Systems" describes the various electric systems for gasoline automobiles. The different types of generators used for ignition and lighting, and the motors for starting both fly wheel and crank shaft drive, are thoroughly illustrated and described. The single-wire system which has always been advocated by the Westinghouse Electric Company is thoroughly explained and its advantages clearly brought out. The details of wiring, such as switches, sockets, fuses, meters, and batteries are also discussed. The last pages of the book are given to a discussion of the various generators and motors.

INDUSTRIAL

INSTRUMENT POSTS.

Instrument posts are used whenever a device is required upon which to mount meters in a power station in place of using an instrument switchboard. The wiring is concealed in the interior of the posts.

The advantages of instrument posts over panel switchboards are that they permit a very convenient and ornamental mounting for meters, beside locating them in such a position that they can readily be observed without obstructing the general view of the operator.

The usual arrangement is to place these posts so as to form a support for the railing of an operating gallery, each post being placed in front of its respective controlling apparatus which is usually located on a suitable controlling pedestal.

The posts may be secured to the floor either by bolting the shank to the side of channel iron beams located under the floor, or by using a bolted flange collar, secured to the post and provided with holes for holding down bolts. When a concrete floor is provided, a socket can be supplied which may be set into the floor, and which is arranged for bolting to the flange collar.

The standard ornamental posts have plates provided at the places where hand railing is usually attached, but when required hand rail bosses may be substituted. These bosses are drilled to take a standard 2-in. pipe, 2⅜ in. outside diameter. Posts with panel bases cannot be arranged for hand railing.

The standard posts are finished in dead black. The posts having panelled bases are supplied with panels of slate with black marine finish.

Two styles of pedestals are made, with ornamental bases and with panelled bases suitable for mounting control apparatus. Each of these styles is also made with stationary top and with swivel top which can be turned about by means of a hand-wheel just above the base.

These instrument posts are manufactured by the Westinghouse Electric & Manufacturing Company.

NEW AUTOMATIC CONTROLLERS.

For centrifugal pumps and similar machines squirrel cage motors connected directly to 1100 and 2200 volt three-phase systems are used to a considerable extent. The use of motors operating at line distributing voltages is frequently desirable for a number of reasons and for the automatic starting of these high tension motors a new line of self-starters has been designed by The Cutler-Hammer Mfg. Company of Milwaukee. These controllers are of the multiple solenoid type consisting of an angle iron, floor type, self-supporting frame, which carries the high tension oil-immersed solenoid switches and necessary relays controlling the motor and auto-transformer circuits.

The oil-immersed type primary and starting switches used are operated by single-phase solenoids. All contacts are entirely enclosed under oil so that no live parts carrying 1100 or 2200 volts are exposed. Low voltage current is used for the operation of the solenoid coils. The capacities of the standard types of these self-starters range from 20 h.p. to 300 h.p., and are made for both 25 and 60 cycle three-phase circuits. They can be automatically controlled when operating on an open tank system by means of a float switch and on a closed or compression tank system, by means of a gauge or diaphragm pressure regulator. For remote control from one or more points control stations can be employed so that the operator need only to push the button to start or stop the motor.

A ONE-KILOWATT TURBO-GENERATOR LIGHTING UNIT.

Light is frequently wanted for limited areas where steam is available but suitable electric power is not, as on contracting operations, small industrial plants, steam launches, etc. To provide a means for supplying electric light under such circumstances, the Westinghouse Electric & Manufacturing Company has recently put on the market a small turbo-generator which will operate an arc lamp and a few incandescents at the same time, or about forty 25-watt Mazda lamps, or their equivalent alone.

This unit is very compact, being only 3 ft. long and 1½ ft. high, and can be installed anywhere provided the unit is kept horizontal.

The turbine and generator are mounted in the same frame. The turbine is of the impulse type and has a governor which keeps the speed uniform for all variations of load and steam pressure. The full rating of one kilowatt will be developed on 90 pounds steam pressure, and satisfactory operation can be obtained with pressures up to 250 pounds. The weight is 283 pounds. The rated voltage of the generator, 120 volts.

TRADE NOTES.

An order has been secured by the General Electric Company, San Francisco, for two 35 kw. 3600 r.p.m 250/250 volt compound wound Curtis turbine generating sets and one 8-panel switchboard, for installation in the new Hobart building, on Market street.

The Simplex Electric Heating Company, Cambridge, Mass., has become, by invitation, a member of The Rice Leaders of the World Association, founded by Elwood E. Rice. This association is an affiliation of some of the leading business concerns in America. It is an indispensable condition, that any firm, to qualify for membership, must have built its business upon principles of honor, quality, strength and service, all of which are depicted in the emblem to be used by association members in all advertising. It is expected that this association and its propaganda will arouse great interest.

An interesting test of a device for increasing the efficiency of automobile engines has been conducted by Professor Robert Sibley at San Francisco. This device is the Farnsworth economizer, or gas generator, which enables the fuel mixture to be heated by exhaust gases from the engine, and thus allows the use of engine distillate, kerosene or gasoline in operating an automobile. Prony brake tests made on a 40 h.p. 4-cylinder machine showed the following results:

	Gasoline 60.6° B. Without Econ-omizer.	Gasoline 60.6° B. With Econ-omizer.	Distillate 49.8° B. With Econ-omizer.
Gallons of fuel per b.h.p.-hr.	.134	.126	.118
Equivalent travel in miles..	67.2	70.2	70.8
Equivalent speed	22.4	23.4	23.6
Miles per gal. of fuel.....	12.6	15.3	16.8
Cost of fuel per gal.....	14.5c	14.5c	7.5c
Fuel cost per b.h.p.-hr.....	1.943c	1.727c	.885c
Fuel oil per mile.....	1.15c	.94c	.44c

When the device was used the tests showed that the load had to be picked up more slowly than when not in use. Throttle adjustments for speed had to be made very slowly, for fear of stalling the motor, and the response in adjusting the throttle was slow and irregular. In no instance was a carbon deposit found on the exhaust valves, the generator bringing about more complete combustion in the engine cylinder.

NEWS NOTES

INCORPORATIONS.

SEATTLE, WASH.—The Power Plant Equipment Company has been incorporated for $15,000 by F. G. Stafford and Van H. Smith with offices at 810 First avenue, south.

ILLUMINATION.

SPOKANE, WASH.—A number of new arc lights have been ordered by the city commissioner.

POCATELLO, IDAHO.—The cluster light system of Pocatello is to be extended to many side streets.

WELLS, NEV.—Frank Jeanney has announced that he is preparing to install an electric light plant here.

LODI, CAL.—The Lodi Gas Company is preparing to do considerable work this summer in the way of extensions in Lodi..

NEWPORT BEACH, CAL.—The board of trustees will receive bids up to March 30th for furnishing material and construction of a street lighting system.

RIVERSIDE, CAL.—The recommendations recently made by the Board of Utilities were adopted by the unanimous vote of the councilmen present at the regular meeting held during the past week.

ANACORTES, WASH.—A hearing on an application of the Pacific Northwest Traction Company for a franchise over county roads to build and operate light and power lines, will be heard April 7th. It is the purpose of the company to supply electricity for lighting and power to the LaConner flats and other rural districts.

VENICE, CAL.—The board of trustees has awarded a contract for the installation of street lighting systems as follows: In San Juan avenue from Electric to Ballona avenue, to K. T. Bennett, for $1278; in Brooks avenue from Electric to Ballona avenue, to D. S. McEwan Electric Company, for $2016; in Broadway from Electric to Compton and Santa Monica road, to D. S. McEwan Electric Company, for $2664.

NAPA, CAL.—The Napa Valley Electric Company has filed suit against the Calistoga Electric Company to compel the sale of the latter company's plant to the Napa Valley Company. The concerns are operating in the northern end of this county. The Napa Valley Company claims it has an agreement written with the Calistoga Company by which the latter promised to sell its plant to the Napa Valley concern on demand, and asks the Superior Court to enforce the agreement.

TRANSMISSION.

STRATHMORE, CAL.—The Mt. Whitney Power Company is to erect a substation at this place.

RIVERSIDE, CAL.—The county supervisors have sold to the Coachella Valley Ice & Electric Company the franchise to run electric power lines from Banning through the Coachella valley to the eastern county line.

ALPINE, TEX.—The plant of the Alpine Power Company has been sold to Geo. Miller, Jackson and Harmon, and J. W. Weaver, by J. P. Wilson, trustees. The plant is to be remodeled and service improved and extended.

REDONDO BEACH, CAL.—The Pacific Light & Power Company has received a building permit for a reinforced concrete building to be erected on its lots in Ocean Beach subdivision, to be used as an addition to its power plants.

GREENVILLE, CAL.—The Great Western Power Company is considering the application of owners of quartz mining interests in the Indian Valley section that the company run a power line from the power plant below Butte Valley into the heart of the quartz belt.

HUNTINGTON BEACH, CAL.—The Pacific Light & Power Company which has constructed the Big Cheek power stations, has finished its transmission lines into this city and has been granted a franchise by the city council for light and power distribution. An application has been made to the State Railway Commission by the Huntington Beach Light & Power Company for authority to sell its distributing system to the Pacific Company. The petitioner asks $21,691 for its properties.

PORTLAND, ORE.—Geo. H. Cecil, U. S. District Forester, has issued a special use permit to the Golden Gate Mining Company, an Arizona corporation, developing mines in the Whitman national forest in the Blue Mountains of Eastern Oregon, to erect a power house, conduit and auxiliary improvements for the generation and transmission of electric power. The company expects to begin work this summer. The power will be used to operate the mines. The power house will be 6 miles from Greenhorn, and 500 h.p. will be developed. A quarter acre reservoir and conduit 4000 ft. long will be installed at an estimated cost of $25,000.

SAN FRANCISCO, CAL.—The department of electricity has filed with the supervisors a statement of the allowance required for next year, amounting to $404,161, approximately four times as much as its appropriation for the present fiscal year, $103,146. It proposes to increase salaries and to enlarge its force of employes as well as to reconstruct the fire and police alarm and signal system. The department asks $4550 for motor cars and other transportation needs, $52,000 for extensions and equipment, $17,000 for general maintenance, $71,621 for new construction, $134,582 for reconstructing the present fire alarm system and $25,000 for new machine shops and yards.

LOS ANGELES, CAL.—The $6,500,000 power bond election will be held May 5th. The ordinance, setting the date and naming the election officers, is now being prepared and will be ready for presentation in a few days. It was also announced that only voters who have registered since January 1st can vote on the power bonds. Opposition to the decision of the council to submit the $6,500,000 project in one issue, and not segregate them into development and distribution, has already developed. Opponents to the single bond issue proposition want the bonds segregated, one issue of $1,250,000 for development of the power projects, and the remainder for distribution of power.

PLACERVILLE, CAL.—To carry out the conditions of the forest service in construction of power plants the Truckee River General Electric Company will probably commence work this summer. The construction work will give employment to many men and make the Georgetown divide a busy section until the electric project is completed. On February 24th approximately 200 acres of land within El Dorado county were withdrawn from entry and designated as power site reserve No. 432, Gerle Creek. This land is embraced within the proposed Gerle Creek and the Rubicon reservoir, parts of the water project of the Truckee River General Electric Company, to which a permit was issued by the forest service September 8, 1913. The stipulations of the permit require the company to commence work within 12 months on unit No. 1 of the project, consisting of several reservoirs and ditches and two power plants known as plants located on Pilot Creek, El Dorado county. That part of the project must be completed and ready for operation in four years of the date of the issuance of the permit.

TRANSPORTATION.

PARKER, ARIZ.—Redmund Toohey, a Phoenix railroad contractor, and W. H. Tharpe, promoter of the new electric railway for Parker valley, recently went over the route of the proposed line and active work is expected to begin soon.

SAN BERNARDINO, CAL.—Rumors are afloat here to the effect that the Pacific Electric Railway Company contemplates in the near future the construction of an electric railway to the crest of the San Bernardino mountains for a sight-seeing line.

OAKLAND, CAL.—A permit for the San Francisco-Oakland Terminal Railways has been asked by San Lorenzo residents, that the company extend its San Lorenzo line to San Lorenzo Grove. The company expressed its willingness to broad gauge and improve the branch road and make extensions which would be about two blocks in length.

SAN FRANCISCO, CAL.—An electric railway from San Francisco to Palo Alto, equipped to meet all the requirements of Peninsula commuters will be built at once if the San Mateo County Development Board procures the right of way. This is the declaration of Fred A. Stokes, who put the project before the executive committee of the San Mateo board, and who says that he can furnish the necessary funds on the day the right of way problem is solved.

SAN FRANCISCO, CAL.—Bids received for the construction of the Van Ness avenue and Chestnut street extensions to the municipal street railway system resulted in a close contest between R. C. Story and Mahoney Bros., the later being the lowest by $192 in work aggregating almost a quarter of a million dollars. The bids were: Healy-Tibbetts Construction Company, $290,800; F. Rolandi, $235,852; R. C. Story, $219,940; Mahoney Bros., $219,747. The city engineer's estimate for the work, including a possible bonus, was $240,000.

SAN JOSE, CAL.—An effort to revive the San Jose Terminal Railway project, a proposed line between this city and Alviso, was made at a recent meeting of the mayor and common council, when Judge F. G. Brown of San Francisco and E. M. Landis of the Tidewater Southern electric road in the San Joaquin Valley, submitted two ordinances which were given first reading. Judge Brown in addressing the council referred to the loss of terminal rates by this city and stated that the proposed line to Alviso might be the means of solving the question of cheap freight rates.

MANILA, P. I.—The Manila Railroad & Electric Light Company is planning to extend its electric railway and electric power company into some of the nearby Provinces of Luzon. T. W. Swift, president of the company, visited Manila to look over the situation. The extensions of the present lines are said to include a line to the town of Parañaque, a further extension of the Malabon line to Obando, and electric lighting lines to near-by towns. The basin of the Angat River will be made the site of the hydroelectric plant the company is planning to install to furnish power.

SALT LAKE CITY, UTAH.—Plans for the floating of bonds amounting to $2,000,000, the proceeds to be used in construction are being made by local interurban lines. The Salt Lake Terminal Railway, a consolidation of the Bamberger road and the Salt Lake & Utah, will benefit in the erection of an uptown terminal. The line of the Salt Lake & Utah, extending from Provo to Payson and southward, will also be constructed from the proceeds. The Salt Lake & Utah, known as the Orem road, has only recently completed its track from Salt Lake City to American Fork and is now at work on the stretch between American Fork and Provo. An issue of $1,000,000 will be floated for the extension to Payson. The other issue of $1,000,000 will be made for the Salt Lake Terminal Company, the money going for shops, yards, tracks, car barns and an up-to-date passenger station.

TELEPHONE AND TELEGRAPH.

SUSANVILLE, CAL.—The people of Willow Creek Valley are planning for the construction of a mutual telephone line from Grasshopper Valley to this city. It will be connected with the Dry Valley and Madeline line.

CENTRALIA, WASH.—The board of county commissioners have granted a franchise to the Bunker Creek Telephone Company and Mary E. Coffman for a telephone line along Bunker Creek and to the Crego Telephone Company for a line into Crego district.

LOS ANGELES, CAL.—Extensive telephone extensions are to be made in the near future in the southeastern part of the city, especially in Walnut Park district. A. B. Cass, president of the Home Telephone & Telegraph Company, states that about $50,000 worth of supplies have been ordered for the work.

WATERWORKS.

SAN FRANCISCO, CAL.—The Board of Public Works has awarded to Scott & Company the contract for installing a water supply system in the new city hall for $13,475.

MILTON, ORE.—To secure money with which to improve the Milton city water supply and to extend and improve the electric light system, the voters of this city will be called upon shortly to authorize an $18,000 bond.

ROUNDUP, MONT.—The $60,000 city waterworks bond issue was sold at public auction in the council chambers of the city. The bonds were bought by the Continental Trust & Savings Bank of Chicago for $62,650 and accrued interest.

CHELAN, WASH.—H. S. Green of the engineering firm of H. S. Green & Company, of Spokane, was here recently in conference with city officials relative to the installing of municipal water plants in the town and in Lakeside.

RATON, N. M.—Hiram Phillips, consulting engineer, and J. B. Gordon, who holds the contract for the construction of the new Raton waterworks, has arrived from Pueblo and states that construction work on the new plant will begin soon.

PENDLETON, ORE.—Signed by 300 voters the initiative petition asking for a special election at which to vote upon a $40,000 bond issue for the completion of the gravity system was presented to the city council. It was referred to a special committee.

OAKLAND, CAL.—An ordinance is being considered by the city council for the appropriation of $30,000 for the extension of the high power salt-pumping station at Fourteenth and Oak streets south on Oak to First and from Oak street on Eighth west to Franklin.

SALEM, ORE.—Frank Bishop of Goble, has filed with State Engineer Lewis an application for a permit to appropriate the waters of a branch of Goble Creek for a municipal supply. Mr. Bishop proposes to extend the present pipe line supplying the city of Goble about two miles further up the stream, and tap a branch in Goble Creek.

HOQUIAM, WASH.—Plans of the city commission to take definite action towards the establishment of a municipal water system developed at a meeting when a resolution outlining the plan was read and laid over for one week. The resolution states the future welfare of the city requires a system of waterworks for an ample supply of water for all purposes.

SAN RAFAEL, CAL.—A right of way through the White Hill tunnel in Marin county of the Northwestern Pacific Company for a water pipe line has been secured by Harvey M. Toy and a group of capitalists, who are organizing a water company which, it is reported, is to supply water to residents of San Rafael, Ross and San Anselmo. Toy has a right of way of four feet on the side of the track for the pipe. His company expects to get its water from the mountains surrounding the San Geronimo Valley, and to supply Lagunitas, Woodacre and San Geronimo with water.

ALPHABETICAL INDEX TO ADVERTISERS

The letter and number before each name are used in the classified page opposite

A-1 American Ever-Ready Co.....
Los Angeles; 755 Folsom Street, San Francisco; Seattle.

B-1 Benjamin Electric Manufacturing Co.....
Rialto Building, San Francisco.

B-2 Berkeley Electric Cooker Co.....
1932 Center Street, Berkeley.

B-3 Blake Signal and Manufacturing Co.....
680 Howard Street, San Francisco.

B-5 Bridgeport Brass Co.....16
(See Pierson, Roeding & Co.)

C-1 Century Electric Co.....4
614 So. Grand Ave., Los Angeles; Salt Lake City; 56 Natoma Street, San Francisco; Seattle; Spokane.

C-2 Crocker-Wheeler Co.....12
Title Insurance Bldg., Los Angeles; Salt Lake City; First National Bank Bldg., San Francisco; Seattle.

C-3 Cutler-Hammer Manufacturing Co.....15
579 Howard Street, San Francisco; Morgan Bldg., Portland, Ore.; San Fernando Bldg., Los Angeles.

D-1 D. & W. Fuse Co.....
(All Jobbers.)

D-2 Dearborn Drug and Chemical Works 12
355 East Second Street, Los Angeles; 301 Front Street, San Francisco.

E-1 Edison Lamp Works of General Electric Co.....15
(See General Electric Company.)

E-2 Edison Storage Battery Supply Co.....12
441 Golden Gate Avenue, San Francisco.

E-3 Electric Agencies Co.....
247 Minna Street, San Francisco.

E-4 Electric Storage Battery Co.....
Pacific Electric Building, Los Angeles; Spalding Building, Portland; 118 New Montgomery Street, San Francisco; Colman Building, Seattle; Pacific Building, Vancouver.

F-1 Fairbanks, Morse & Co.....
Los Angeles; Portland; 651 Mission Street, San Francisco; Seattle; Spokane.

F-2 Fort Wayne Electric Works of G. E. Co.....
Rialto Building, San Francisco; Colman Building, Seattle.

G-1 General Electric Co.....14
124 W. Fourth Street, Los Angeles; Worcester Building, Portland; Rialto Building, San Francisco; Colman Building, Seattle; Paulsen Building, Spokane.

H-1 Habirshaw Wire Co.....
(See Western Electric Company.)

H-2 Hemingray Glass Co.....12
330 So. L. A. Street, Los Angeles; 345 Oak Street, Portland; 807 Mission Street, San Francisco.

H-3 Hoagland-Hulse Electric Co.....
1707 Naud Street, Los Angeles.

H-4 Hunt, Mirk & Co.....
141 Second Street, San Francisco.

I-1 Indiana Rubber and Insulated Wire Co.....16
807 Mission Street, San Francisco.

K-1 Kellogg Switchboard and Supply Co.....
Aronson Building, San Francisco.

K-2 Keystone Boiler Works.....
201 Folsom Street, San Francisco

K-3 Klein & Sons, Mathias.....12
579 Howard Street, San Francisco.

K-4 K-P-F Electric Co.....3
37 Stevenson Street, San Francisco.

L-1 Leahy Manufacturing Co.....12
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L-2 Locke Insulator Manufacturing Co.....4
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M-1 Mannesmannrohren-Werke .....
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M-2 McGlauflin Manufacturing Co.....12
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M-3 Moore & Co., Charles C.....5
Van Nuys Building, Los Angeles; Spalding Building, Portland; Kearns Building, Salt Lake City; 40 First Street, San Francisco; Mutual Life Building, Seattle; Santa Rita Hotel Building, Tucson.

M-4 Morse Chain Co.....
Monadnock Bldg., San Francisco.

N-1 Nason & Co., R. N.....
151 Potrero Avenue, San Francisco.

N-2 National Conduit & Cable Co., The.....
Trust and Savings Building, Los Angeles; Rialto Building, San Francisco.

N-3 National Lamp Works of G. E. Co.....
(All Jobbers.)

N-4 New York Insulated Wire Co.....
629 Howard Street, San Francisco.

N-5 Norris Co., L. A. .....
Monadnock Building, San Francisco.

O-1 Okonite Co. 16
(All Jobbers.)

P-1 Pacific Electric Manufacturing Co.....
80 Tehama Street, San Francisco.

P-2 Pacific States Electric Co.....2
526 So. L. A. Street, Los Angeles; 90 Seventh Street, Portland; 526 Thirteenth Street, Oakland; 575 Mission Street, San Francisco; 307 First Ave., So., Seattle.

P-3 Parker Boiler Co.....
201 Folsom Street, San Francisco.

P-4 Pelton Water Wheel Co.....12
2219 Harrison Street, San Francisco.

P-5 Pierson, Roeding & Co.....3-4-16
Pacific Electric Building, Los Angeles; Spalding Building, Portland; Rialto Building, San Francisco; Colman Building, Seattle; Pacific Building, Vancouver.

P-7 Pittsburg Piping & Equipment Co.....16
Monadnock Building, San Francisco.

S-1 Schaw-Batcher Company, Pipe Works, The.....
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S-2 Simonds Machinery Co.....
12 Natoma Street, San Francisco.

S-3 Simplex Electric Heating Co.....4
612 Howard Street, San Francisco.

S-4 Southern Pacific Co.....4
Flood Building, San Francisco.

S-5 Sprague Electric Works of G. E. Co.....4
Rialto Building, San Francisco; Colman Building, Seattle.

S-6 Standard Underground Cable Co.....
First National Bank Bldg., San Francisco; Hibernian Bldg., Los Angeles; Yeon Bldg., Portland, Or.; Central Bldg., Seattle, Wash.

S-7 Staples & Pfeiffer.....
102 Steuart Street, San Francisco.

T-1 Thomas & Co., R.....
(See Western Electric Co.)

V-1 Van Emon Elevator Co.....
56 Natoma Street, San Francisco.

W-1 Wagner Electric Manufacturing Co.....3
Rialto Building, San Francisco.

W-2 Western Electric Co.....
119 East Seventh Street, Los Angeles; 507 Sixteenth Street, Oakland; 680 Folsom Street, San Francisco; 1518 First Avenue, So., Seattle.

W-3 Westinghouse-Church-Kerr Co.....
Pacific Electric Building, Los Angeles; Pacific Building, San Francisco.

W-4 Westinghouse Electric and Manufacturing Co.....6
50-52 East Broadway, Butte; Van Nuys Building, Los Angeles; Couch Building, Portland; 212 So. W. Temple, Salt Lake City; 165 Second Street, San Francisco; Central Building, Seattle; Paulsen Building, Spokane.

W-5 Westinghouse Machine Co.....
141 Second Street, San Francisco.

W-6 Westinghouse Lamp Co.....
(See Westinghouse Electric and Manufacturing Co.)

W-7 Weston Electrical Instrument Co.....3
682 Mission Street, San Francisco.

W-8 Western Pipe & Steel Co.....
444 Market Street, San Francisco; 1758 North Broadway, Los Angeles.